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ABSTRACT

A project examined the skill gaps within the aerospace industry, identified and prioritized the skills common to all jobs and work areas within the industry, and provided insight into the skills that workers need to upgrade and develop. The research was conducted June-August 1994 at Bristol Aerospace's Winnipeg, Manitoba, operations. The basic skills needs assessment consisted of the basic skills survey and workplace reading materials assessment. The basic skills survey was comprised of confidential interviews with 125 participants. The questionnaire gathered information on background, education, and basic job site skills the participants perceived themselves as using to do their jobs. Data were analyzed to determine the critical, essential, and important workplace literacy skills based on the percentage and frequency of use. The reading materials assessment consisted of analysis of representative reading materials from throughout Bristol's operations. General company/union documents and government documents were found to be overly complicated in language, structure, and presentation format. Documents ranged from very easy to very difficult in readability throughout the work force with little correlation to educational background of the writer or intended reader. Recommendations were made regarding curriculum development; program delivery; and course development. (Appendixes include the survey, ranked use and frequency of use tables, and 15 references.) (YLB)

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ED 380 694

WORKPLACE EDUCATION MANITOBA
&
MANITOBA AEROSPACE HUMAN RESOURCES COORDINATING COMMITTEE

AEROSPACE SECTOR

BASIC SKILLS NEEDS ASSESSMENT

ROLLS
ROYCE

BRISTOL
AEROSPACE
LIMITED

&

CANADIAN AUTO WORKERS, LOCAL 3005

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CE068 688

By Lee Thomas Cole
Educational Technology Consultant, 1994

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INTRODUCTION

THE PROBLEM

The aerospace industry, in response to changing global markets, is undergoing a restructuring of the traditional workplace environment. This restructured workplace is placing new demands on workers basic reading, writing, and mathematical skills. Physical workplace changes combined with the introduction of new management philosophies and structures require workers to develop a strong grasp of computer skills, social communication skills, problem solving skills, and information processing skills.. The purpose of this project was to examine the skill gaps within the industry, to identify and prioritize the skills common to all jobs and work-areas within the industry, and to provide insight into the skills that workers need to upgrade and develop.

THE PROCESS

The research for the project was conducted from June 1, 1994 to August 1994 at Bristol Aerospace's Winnipeg Manitoba operations. The Basic Skills Needs Assessment consists of two parts: Basic Skills Survey, and Workplace Reading Materials Assessment.

Basic Skills Survey:

This portion of the study was comprised of confidential interviews with 125 randomly selected participants, representing 7 work areas, consisting of; skilled manual workers, skilled craftspersons, supervisors, clerical and sales personnel, technical personnel, professionals, and management personnel. The interview questionnaire utilized 350 questions to gather information on the background, education, and basic job site skills the participants perceived themselves as using to do their jobs.

Workplace Reading Materials Assessment:

This portion of the study consisted of the analysis of representative reading materials from throughout Bristol's operations for readability levels. Samples were collected from materials that are common to all work areas, as well as from materials that are work-area specific. Samples were analyzed for readability levels using eight comparative diagnostic computer indexes to determine the grade level required to read and comprehend the document.

MAJOR FINDINGS

DEMOGRAPHIC BACKGROUND

- 84.00% of participants were male, 16.00% female.
- 32.00% of participants are aged 34 to 42 years, this represents the largest single age group.
- 41.60% of participants are over the age of 40.
- 16.00% of participants claim a first language other than French or English.
- 16.00% of participants read and write languages other than French or English.
- 19.20% of participants have held their current job classification for less than 2 years.
- 14.40% of participants have been in the aerospace industry for less than 5 years.
- 14.40% of participants have been in the aerospace industry for more than 20 plus years.

EDUCATION

Location of Educational Experience:

- 48.80% of the total workforce were educated in Winnipeg.
- 65.60% of the total workforce were educated in Manitoba.
- 12.00% of the total workforce were educated in other Canadian provinces.
- 77.00% of the total workforce were educated in Canada.
- 23.00% of the total workforce were educated in countries other than Canada.

Secondary Schooling:

- 2.40% of the total workforce [4.17% of the hourly workforce] completed grade 8.
- 67.00% of the total workforce completed grade 12.
- 29.60% of the total workforce [34.72% of the hourly workforce] completed some form of pre-apprenticeship training.
- 7.20% of the total workforce [9.72% of the hourly workforce] completed an apprenticeship.
- 21.60% of the total workforce [33.96% of the salaried workforce] completed a 2 year certificate or diploma program.
- 11.20% of the total workforce [22.64% of the salaried workforce] completed a 4 year degree program.

EDUCATION [cont.]

Learning Preferences

- 57.60% to 68.00% of the total workforce would like to attend ***basic reading, writing, math, or speaking courses.***
- 64.80% of the total workforce would prefer to attend educational courses ***presented on the jobsite.***
- 75.20% of the total workforce would prefer to attend educational courses in a ***classroom setting***.
- 66.40% of the total workforce would prefer to attend educational courses in the ***middle of the workweek***.

Skills Acquisition

- 37.60% of the total workforce rate ***computer data management*** as a desirable skill to obtain based on their work experience.
- 36.80% of the total workforce rate ***problem solving*** as a desirable skill to obtain based on their work experience.
- 35.20% of the total workforce rate ***communications*** as a desirable skill to obtain based on their work experience
- 33.60% of the total workforce rate ***computer programming*** as a desirable skill to obtain based on their work experience
- 30.40% of the total workforce rate ***computer numerical control*** as a desirable skill to obtain based on their work experience
- 29.60% of the total workforce rate ***study skills*** as desirable skills to obtain based on their work experience
- 28.80% of the total workforce rate ***drafting/print reading*** as a desirable skill to obtain based on their work experience
- 25.60% of the total workforce rate ***technical writing*** as a desirable skill to obtain based on their work experience

EDUCATION [cont.]

The following table illustrates the percentage of participants who would attend basic skills courses in the subject areas outlined if offered in the workplace.

Work Group	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical Sales	Technical	Professional	Management
Reading	57.60%	59.72%	54.72%	61.54%	57.58%	25.00%	81.82%	63.16%	27.27%	50.00%
Writing	61.60%	59.72%	64.15%	61.54%	57.58%	25.00%	100%	78.95%	27.27%	50.00%
Math	67.20%	69.44%	64.15%	71.79%	66.67%	25.00%	90.91%	68.42%	36.36%	75.00%
Speaking	68.00%	66.67%	69.81%	61.54%	72.73%	50.00%	90.91%	84.21%	45.45%	50.00%

BASIC SKILLS SURVEY

Establishment of Criteria

To determine core workplace literacy skills, a set of criteria was used. These were based on the degree of use as indicated by the percentage of affirmative [yes] responses and the frequency of use as indicated by the combined percentage of daily and weekly use.

Critical Workplace Literacy Skills

A skill was deemed critical if the percentage of affirmative responses > 90% and the combined percentage for usage on a daily or weekly basis, > 80%.

Essential Workplace Literacy Skills

If the affirmative response rate was > 75% and the usage was > 65%, then the skill was deemed essential.

Important Workplace Literacy Skills

If the affirmative response rate was > 60% and the usage was > 50%, then the skill was deemed essential.

BASIC SKILLS SURVEY

Core Workplace Skills

The following skills have been deemed critical, essential, or important to the performance of job tasks or duties by a majority of the workforce. A graphic presentation of the ranked order of these skills can be found in the Main Report, Survey Results Part 2.

Reading Skills

- Work area reading skills; drawings and sketches, production/work schedules, specifications, computer screens and printouts, charts, tables and graphs, check lists, memos and notes, time/log sheets, manuals, and symbols, reading materials that reflect directly on the specific work area and day to day performance of the worker.
- Company and union reading materials rank as essential when frequency of use is adjusted to monthly.

Mathematics Skills

- Basic mathematics; the addition, subtraction, multiplication and division of whole numbers and decimals, as well as estimation skills.
- Technical mathematics; graphs, charts, tables, scale drawings, lines and angles, 2 and 3 dimensional shapes, problem solving, and numerical specifications.
- Measurement skills and the development of precision, accuracy, and a understanding of the application of tolerances.
- Hand tools; tape measures, scales, gauges and dials, calculators, and computers.

Communication Skills

- Writing skills; filling in forms, keeping track of hours, notes and memos, instructions, and making drawings or sketches.
- Oral skills; the ability to give and follow written or verbal directions, ask questions, take messages, and use the telephone.
- Communication tools; the use of the mainframe or personal computer, photocopier, the ability to coordinate work groups and work with trade groups.
- Social skills; the ability to work independently is important to the total workforce, teamwork is an essential skill to the salaried workforce.

BASIC SKILLS SURVEY

Core Workplace Skills [cont.]

Productive Thinking Skills

- Information processing skills; research and information analysis, systems analysis [trouble shooting], identifying deficiencies, summarizing and condensing information, recognizing associations, forming conclusions, making predictions, and decision making.
- Judgment and decision making skills; identifying facts, recognizing evidence, organization of data, and evaluating judgments.
- Problem solving skills; independent problem solving, identification and clarification of problems, formulating solutions, and directing others in the application of solutions.
- Formal reasoning, critical thinking, and logic skills; determining meanings, noticing qualities and stages of things, breaking down and sorting components, judging credibility, detecting bias, distinguishing relevance, using evidence, analyzing and evaluating, and using syllogistic reasoning [deductive reasoning].
- Creative thinking skills; analyzing open-ended situations, generating ideas, examining alternatives, ranking alternatives, using insight and intuition, identifying relationships, elaborating details, synthesis, extrapolating, using imagery, and using metacognitive processes [thinking about one's own thinking].

MATERIAL READABILITY ASSESSMENT

- General company / union documents and government documents would appear to be overly complicated in language, structure and presentation format.
- Documents range from very easy to very difficult in readability throughout the workforce with little correlation to educational background of the writer or intended reader.

RECOMMENDATIONS

GENERAL RECOMMENDATIONS

- That a distinction be made between the teaching of basic skills and task specific training traditionally offered the hourly workforce.
- That the existing employer/employee relationship be broadened to encourage a learning continuum for all.
- That a data base of available community resources be compiled and made available to the workforce.
- That the inclusion and success of all workers be a priority in the development and delivery of programs.
- That the inclusion of an English as a second language component be a priority in program development.

CURRICULUM DEVELOPMENT

- That a teaching philosophy be implemented in the development and presentation of all courses
- That all curriculum development be constructed utilizing a lifelong learning approach to basic skills development.
- That general industry specific basic skills courses be developed using general contextual materials
- That work area contextual courses be developed to address the needs of individual work groups.
- That an educational technology specialist be employed or contracted to develop a short and long term industry specific Basic Skills Curriculum and delivery strategy.
- That all courses be designed to be implemented in the workplace and allow for the participation of all workers.
- That all courses utilize materials that are clearly relevant to the workplace or employment issues.
- That a communications strategy be developed and implemented to address the gap evident within the company. Communication skills can only be utilized if well defined avenues exist for their use.

PROGRAM DELIVERY

General Observations

- That an in house classroom facility be developed for the presentation of courses, and that course specialists be brought in to present materials as opposed to sending workers to outside learning facilities, thus fostering a learning environment and mentality within the company and workforce.
- That computer assisted courseware be utilized to introduce and develop computer skills throughout the workforce

Computer Assisted Courseware

- With the acquisition of basic computer skills being requested as a priority course by the survey participants, the conclusion can be made that if an introductory computer skills tutorial is used as an introduction to other skill topics, a degree of participant motivation would be built into the basic skills curriculum.

Consultants Comments:

Computer assisted learning offers an approach to basic skills development & upgrading that can provide generic introductory material as well as be adapted to provide contextual instruction. Adult learners often prefer the privacy and self controlled pace of these learning systems.

The graphical nature of the Windows 3.1 operating system for IBM based systems is extremely useful as a presentation medium and with the development of multi-media CD Rom systems, sound and video can be incorporated into tutorials providing a degree of familiarity while providing learners with a dramatic interesting learning package.

Computer assisted learning systems can be programmed to quiz learners at critical intervals in course content, can record results, and provide easy access to data allowing the learner to visually track their own progress. If learning systems are integrated into main frame and desktop networks all ready in place, or planed for the workplace, the curriculum could be accessible to a multitude learners at a variety of times and locations.

COURSE DEVELOPMENT

- That courses in basic reading, writing, math, communications, problem solving and teamwork skills be offered to all employees in the workplace.
- Industry, company, and work area contextual courses, should be developed with attention given to the following skills areas:

Reading Courses:

- Basic reading strategies
- Interpreting technical materials
- Interpreting drawings and sketches
- Interpreting schedules
- Interpreting charts, tables and graphs
- Understanding company documents and document systems
- Filling in forms
- Using technical terminology [when and why]
- Interpreting employment materials: collective agreement, benefits and deductions, etc.

Communications:

- Basic writing skills
- Technical writing
- Plain language writing
- Drawing and sketching
- Form development
- Giving and receiving directions and instructions
- Using communication technologies
- Teamwork

Math:

- Basic mathematics
- Imperial and metric measurements
- Interpreting numerical specifications
- Estimating
- Interpreting gauges, dials and readouts
- Measurement systems and tools
- Using calculators
- Statistical analysis

Productive Thinking:

- Basic information processing systems
- Basic problem solving strategies
- Team problem solving strategies
- Systems analysis
- Decision making
- Assessment strategies
- Evaluation methodologies
- Deductive reasoning strategies

Computer Courses:

- Basic introduction to computers
- Word processing
- Developing presentations
- Using project management software
- Creating charts and graphs
- Using computer communications technologies

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INTRODUCTION

BACKGROUND

The changing global marketplace is altering the traditional structures and skill needs of the Manitoba aerospace industry. This restructured workplace is placing new demands on workers basic workplace literacy skills [reading, writing, and mathematical skills] needed to perform job tasks and duties. Changes in the physical workplace combined with the introduction of new management philosophies and structures require workers to command a strong grasp of computer skills, social communication skills, teamwork skills, information processing skills, and problem solving skills. To better prepare future and current employees within the industry and to provide viable data for the development of relevant workplace training programs, the workplace literacy and employability skills inherent within the industry need to be identified and prioritized, interest in skills upgrading assessed and recommendations for program development made.

This project was co-funded by Workplace Education Manitoba and the Manitoba Aerospace Human Resources Committee and was directed by a project team. The team consisted of the following representatives; Canadian Auto Workers-Local 3005; Allen Ireland and Wayne Martel, Bristol Aerospace, Rob Perry and Wendel Wiebe, Workplace Education Manitoba; Sue Turner and Lee Thomas Cole

PROJECT GOALS AND OBJECTIVES

Goals

The goal of this project is to identify and prioritize the generic workplace literacy skills common across all jobs/occupations within the industry, [reading, writing, mathematics, communication, and productive thinking skills]; to provide a statistical reference base for future curriculum and course development and to develop recommendations to the industry for program development.

Objectives

In order to meet the goal of the project, the following objectives were established:

- Conduct an organizational needs assessment [ONA] to determine the workplace literacy tasks performed by workers within the aerospace sector.
- Develop an instrument to survey a representative cross section of workers in the Manitoba aerospace sector.
- Conduct a readability analysis of a representative selection of work related literature, manuals, etc
- Collate and analyze collected data so as to identify the essential, critical and important skills required of workers within the industry.

ABBREVIATIONS & DEFINITIONS

For this project the following terms were used.

- **Workplace Literacy Skills:** the reading, mathematical and communication skills needed to carry out job related tasks and duties
- **Employability Skills:** the information processing, judgment and decision making, problem solving, formal reasoning, logic, critical and creative thinking skills required to gain and maintain employment, and to function effectively in the workplace.
- **Total Workforce:** the combined employees of Bristol Aerospace who participated in the project. [125 participants]
- **Hourly Workforce:** the unionized members of the workforce who participated in the project [72 participants]
- **Salaried Workforce:** the non unionized members of the workforce who participated in the project [53 participants]
- **Skilled Manual:** this workgroup consisted of composite fabricators, sheet metal mechanics I & II, painters, electro/chemical platers, tool grinders, maintenance workers, process blasters and sweeper/laundry workers.
- **Skilled Craftspersons:** this work group consisted of; A/C mechanics I & II, avionics mechanics I & II, instrument mechanics, rocket mechanics, machinists I & II, tool & die makers, welders & machine welders, carpenters, special process inspectors, manufacturing inspectors, and aircraft avionics inspectors.
- **Supervisors:** this workgroup consisted of; the heads of work areas i.e.: maintenance, stores, shops, etc.
- **Clerical/Sales:** this workgroup consisted of; secretaries, clerks I, II & III, contracts administrators, and typists.
- **Technical:** this workgroup consisted of; planers, buyers, estimators, design technicians, electronics technicians, computer technicians, lab technicians, technical illustrators and drafters.
- **Professional:** this workgroup consisted of engineers and computer programmers & analysts.
- **Management:** this workgroup consisted of; departmental managers, project managers and product and quality managers.

INSTRUMENT DEVELOPMENT

The interview questionnaire utilized to conduct the Basic Skills Need Assessment draws on the work of Thomas J. Sork, Ph.D, Asso. Professor of Adult Education, University of British Columbia [1994], the British Columbia Construction Industry Skills Improvement Council [1993], the National/State Leadership Training Institute on the Gifted and Talented[1988], McKeag [1993], Cole [1994] and the continuing educational research of the consultant.

The consultant provided the project team with a generic skills checklist [developed during Organizational Needs Assessments of other Manitoba industrial sectors], this was reviewed by the project team, and after a series of focus groups with members of the union and management in which additional skills were identified, was revised to include the industry specific skills used by the aerospace industry.

A revised draft was pilot tested with the help of supervisors from throughout the operations and with the executive of the union. The results were correlated and analyzed by the consultant. A revised draft was submitted to the project team and approved as reflecting the scope and concern of the basic skills inherent in the industry.

DATA COLLECTION

The instrument examines reading, mathematics, communications and productive thinking skills. Each skill area is broken down in to sub-sections [i.e.: *reading skills*, job site reading skills, company and union materials, etc.]. Responses were recorded as a yes if the item was a factor in the completion of the participants job, as a no if the item was not a factor in job performance. If the response was yes the frequency of use was recorded as daily, weekly, monthly or 1/2 year.

The consultant was provided with a list of all Bristol employees. The workforce was broken into seven general work groups based the job equity classifications. The consultant used a random selection computer sub-program to select employees to represent ten percent [10%]of each work group. In the case of union employees the selection process was refined to ensure all trades and union classifications were proportionally represented. The interview list was then reviewed and approved by the project team. An interview schedule was developed and invitations to a confidential interview with the consultant were sent to individual workers.

The consultant provided all participants with a copy of the survey instrument. Each question in the survey instrument was read aloud to the participant by the consultant. The participants verbal response to the questions were recorded by the consultant. Completed survey forms were coded for work areas and treated confidentially by the consultant.

PROJECT PARTICIPANTS

The individuals approached to participate in this project, were randomly selected from the Bristol Aerospace employee listings and represent a cross section of abilities and personalities from throughout the workforce. One hundred and twenty five [125] people voluntarily took the time to examine the skills they use to complete their jobs and to contribute to the results of the project.

Participants were divided into ten classifications based on work area. These classifications are presented as; total workforce, hourly workforce, salaried workforce, skilled manual, skilled craftsperson, supervisor, clerical / sales, technical, professional, and management throughout this document.

Each individual answered 359 questions requiring 587 responses as part of the Basic Skills Survey, which produced 186,075 units of data.

Table 1

Work Area Classification	Number of workers surveyed
Skilled Manual	39
Skilled Craftsperson	33
Supervisor	4
Clerical/Sales	11
Technical	19
Professional	11
Management	8
Salaried Workforce	72
Hourly Workforce	53
Total Workforce	125

DATA ANALYSIS

Descriptive statistics were used to analyze the data. The data was coded and the EXCEL 4 [Microsoft Corp. 1994] program was used. Because there was no existing database of workplace literacy skills with regard to the aerospace industry in Manitoba, the calculated percentages and frequencies for affirmative [yes] response and high frequency of use were tabulated and examined for each workplace literacy skill.

To determine core workplace literacy skills, a set of criteria was used. These were based on the degree of use as indicated by the percentage of affirmative [yes] responses and the frequency of use as indicated by the combined percentage of daily and weekly use.

Critical Workplace Literacy Skills

A skill was deemed critical if the percentage of affirmative responses > 90% and the combined percentage for usage on a daily or weekly basis, > 80%.

Essential Workplace Literacy Skills

If the affirmative response rate was > 75% and the usage was > 65%, then the skill was deemed essential.

Important Workplace Literacy Skills

If the affirmative response rate was > 60% and the usage was > 50%, then the skill was deemed essential.

SURVEY RESULTS PART 1

DEMOGRAPHIC BACKGROUND

- 84.00% of participants were male, 16.00% female.
- 32.00% of participants are aged 34 to 42 years, this represents the largest single age group.
- 41.60% of participants are over the age of 40.
- 16.00% of participants claim a first language other than French or English.
- 16.00% of participants read and write languages other than French or English.
- 19.20% of participants have held their current job classification for less than 2 years.
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EDUCATION

Location of Educational Experience:

- 48.80% of the total workforce were educated in Winnipeg.
- 65.60% of the total workforce were educated in Manitoba.
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- 11.20% of the total workforce [22.64% of the salaried workforce] completed a 4 year degree program.

EDUCATION [cont.]

Courses Completed

Table 2 illustrates the percentage of participants that completed courses in the subject areas outlined during their educational experiences.

[Responses are presented by general work group in rank order]

Table 2

Total Workforce		Hourly Workforce		Salaried Workforce	
Subject	**%**	**Subject**	**%**	**Subject**	**%**
General Math	59.20%	General Science	62.50%	Algebra	60.38%
General Science	56.80%	General Math	61.11%	General Math	56.60%
Algebra	55.20%	Geometry	56.94%	Geometry	49.06%
Geometry	53.60%	Algebra	51.39%	General Science	49.06%
Chemistry	44.00%	Drafting / Print Reading	47.22%	Chemistry	45.28%
Drafting / Print Reading	43.20%	Physics	44.44%	Computers	39.62%
Physics	40.80%	Chemistry	43.06%	Drafting / Print Reading	37.74%
Metalworking	32.80%	Shop Math	38.89%	Business	37.74%
Shop Math	31.20%	Metalworking	36.11%	Writing Skills	37.74%
Typing	30.40%	Trigonometry	30.56%	Physics	35.85%
Trigonometry	29.60%	Electricity	30.56%	Typing	33.96%
Electricity	29.60%	Typing	27.78%	Problem Solving	30.19%
Writing Skills	28.80%	Hydraulics/pneumatics	25.00%	Trigonometry	28.30%
Computers	27.20%	Writing Skills	22.22%	Metalworking	28.30%
Business	24.80%	Personal Communications	22.22%	Electricity	28.30%
Technology	22.40%	Electronics	20.83%	Technical Writing	28.30%
Personal Communications	22.40%	Technology	19.44%	Calculus	26.42%
Hydraulics/pneumatics	21.60%	Computers	18.06%	Statistics	26.42%
Problem Solving	21.60%	Technical Writing	15.28%	Technology	26.42%
Electronics	20.80%	Problem Solving	15.28%	Personal Communications	22.64%
Technical Writing	20.80%	Business	15.28%	Electronics	20.75%
Statistics	16.80%	Pre Apprenticeship	11.11%	Shop Math	20.75%
Calculus	14.40%	Statistics	9.72%	Hydraulics/pneumatics	16.98%
Reading Improvement	11.20%	Reading Improvement	9.72%	Reading Improvement	13.21%
Cad / Cam	9.60%	Cad / Cam	8.33%	Cad / Cam	11.32%
Pre Apprenticeship	9.60%	Calculus	5.56%	Co-op Work Experience	9.43%
Co-op Work Experience	7.20%	Co-op Work Experience	5.56%	Pre Apprenticeship	7.55%
English as a second language	4.80%	English as a second language	5.56%	English as a second language	3.77%
Other	0.80%	Other	1.39%	Other	0.00%

EDUCATION [cont.]

Desired Training Opportunities

Table 3 illustrates the percentage of participants interested in obtaining or upgrading skills in the subject areas outlined, based on their work experiences.

[Responses are presented by general work group in rank order]

Table 3

Total Workforce		Hourly Workforce		Salaried Workforce	
Subject	**%**	**Subject**	**%**	**Subject**	**%**
Computer Data Management	37.60%	Computer Data Management	41.67%	Problem Solving	39.62%
Problem Solving	36.80%	Computer Programming	37.50%	Computer Data Management	32.08%
Communications	35.20%	Communications	37.50%	Communications	32.08%
Computer Programming	33.60%	Drafting / Print Reading	34.72%	Technical Writing	28.30%
Computer Numerical Control	30.40%	Problem Solving	34.72%	Computer Programming	28.30%
Study Skills	29.60%	Study Skills	34.72%	Computer Numerical Control	26.42%
Drafting / Print Reading	28.80%	Computer Numerical Control	33.33%	Study Skills	22.64%
Technical Writing	25.60%	Geometry	30.56%	Statistics	20.75%
Shop Math	22.40%	Trigonometry	30.56%	Drafting / Print Reading	20.75%
Algebra	21.60%	Physics	30.56%	Algebra	13.21%
Statistics	21.60%	Shop Math	29.17%	Shop Math	13.21%
Geometry	20.80%	Metalworking	29.17%	General Science	13.21%
Physics	20.80%	Electronics	29.17%	General Math	11.32%
Electronics	20.80%	Algebra	27.78%	Electronics	9.43%
Trigonometry	18.40%	Hydraulics/pneumatics]	26.39%	Geometry	7.55%
Metalworking	18.40%	Technical Writing	23.61%	Chemistry	7.55%
Hydraulics/pneumatics	18.40%	Statistics	22.22%	Physics	7.55%
General Science	16.80%	Chemistry	20.83%	Hydraulics/pneumatics	7.55%
General Math	16.00%	General Math	19.44%	Calculus	5.66%
Chemistry	15.20%	General Science	19.44%	Electricity	5.66%
Calculus	12.80%	Calculus	18.06%	Metalworking	3.77%
Electricity	12.80%	Electricity	18.06%	Trigonometry	1.89%

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TRADES AND WORKPLACE TRAINING

Table 4 illustrates the percentage of participants who would attend basic skills courses in the subject areas outlined if offered in the workplace.

Table 4

Work Group	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Reading	57.60%	59.72%	54.72%	61.54%	57.58%	25.00%	81.82%	63.16%	27.27%	50.00%
Writing	61.60%	59.72%	64.15%	61.54%	57.58%	25.00%	100.00%	78.95%	27.27%	50.00%
Math	67.20%	69.44%	64.15%	71.79%	66.67%	25.00%	90.91%	68.42%	36.36%	75.00%
Speaking	68.00%	66.67%	69.81%	61.54%	72.73%	50.00%	90.91%	84.21%	45.45%	50.00%

Table 5 illustrates the percentage of participants who have taken courses offered by the Union / Labor Relations Association.

Table 5

Work Group	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Yes	5.60%	6.94%	3.77%	5.13%	9.09%			5.26%		12.50%
No	94.40%	93.06%	96.23%	94.87%	90.91%	100.00%	100.00%	94.74%	100.00%	87.50%

Table 6 illustrates the percentage of participants who have taken courses on their own, night school, community college, etc.

Table 6

Work Group	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Yes	47.20%	38.89%	58.49%	30.77%	48.48%	50.00%	63.64%	73.68%	27.27%	62.50%
No	52.80%	61.11%	41.51%	69.23%	51.52%	50.00%	36.36%	26.32%	72.73%	37.50%

Table 7 illustrates the percentage of participants who have trade papers or tickets.

Table 7

Work Group	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Yes	18.40%	22.22%	13.21%	10.26%	36.36%	50.00%	9.09%	10.53%	9.09%	12.50%
No	81.60%	77.78%	86.79%	89.74%	63.64%	50.00%	90.91%	89.47%	90.91%	87.50%

LEARNING PREFERENCES

Table 8 illustrates the day of the week the majority of the workforce would prefer to attend class.

Table 8

Weekday	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Monday	51.20%	47.22%	56.60%	35.90%	60.61%	0.00%	54.55%	63.16%	72.73%	50.00%
Tuesday	67.20%	66.67%	67.92%	69.23%	63.64%	25.00%	72.73%	63.16%	81.82%	75.00%
Wednesday	66.40%	69.44%	62.26%	71.79%	66.67%	25.00%	45.45%	63.16%	72.73%	87.50%
Thursday	60.00%	62.50%	56.60%	66.67%	57.58%	25.00%	45.45%	57.89%	63.64%	75.00%
Friday	28.00%	30.56%	24.53%	33.33%	27.27%	25.00%	18.18%	21.05%	18.18%	50.00%

Table 9 illustrates the time of day the majority of the workforce would prefer to attend class.

Table 9

Time of day	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Mornings	60.00%	63.89%	54.72%	61.54%	66.67%	25.00%	45.45%	57.89%	54.55%	75.00%
Afternoons	43.20%	43.06%	43.40%	43.59%	42.42%	75.00%	18.18%	42.11%	54.55%	50.00%
Evenings	23.20%	19.44%	28.30%	20.51%	18.18%	0.00%	18.18%	31.58%	27.27%	50.00%

Table 10 illustrates the frequency of instruction the majority of the workforce would prefer.

Table 10

Frequency of instruction	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Once per week	61.60%	58.33%	66.04%	56.41%	60.61%	50.00%	63.64%	68.42%	54.55%	87.50%
Twice per week	60.00%	58.33%	62.26%	51.28%	66.67%	50.00%	63.64%	52.63%	72.73%	75.00%

Table 11 illustrates the instructional style the majority of the workforce would prefer.

Table 11

Instructional style	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
Classroom	75.20%	77.78%	71.70%	76.92%	78.79%	25.00%	63.64%	78.95%	72.73%	87.50%
Correspondence	32.80%	40.28%	22.64%	35.90%	45.45%	50.00%	9.09%	21.05%	45.45%	0.00%
Computer assisted	39.20%	43.06%	33.96%	38.46%	48.48%	25.00%	27.27%	47.37%	36.36%	12.50%

Table 12 illustrates the location the majority of the workforce would prefer to attend class.

Table 12

Location	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisors	Clerical/Sales	Technical	Professional	Management
School	17.60%	9.72%	28.30%	10.26%	9.09%	25.00%	9.09%	10.53%	54.55%	62.50%
Job site	64.80%	65.28%	64.15%	53.85%	78.79%	50.00%	81.82%	73.68%	54.55%	37.50%
Outside job site	16.00%	19.44%	11.32%	28.21%	9.09%	25.00%	9.09%	10.53%	0.00%	25.00%
Union hall	4.80%	2.78%	7.55%	2.56%	3.03%	0.00%	0.00%	10.53%	18.18%	0.00%

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SURVEY RESULTS PART 2

WORKPLACE SKILLS ASSESSMENT

The following tables illustrate the results of the basic skills usage portion of the worker interviews. Core workplace skills, those deemed Critical, Essential, or Important by the analysis criteria, are presented for the three major workforce groupings,[Total Workforce, Hourly Workforce, Salaried Workforce], and for each of the seven subgroups of the workforce,[Skilled Manual, Skilled Craftsperson, Supervisors, Clerical/Sales, Technical, Professional, Management]. Core workplace skills are represented by the letter C-critical, E-essential, I-important, rank order is represented by superscript numerals attached to the designated letters. Skills are listed in the order they appeared in the Basic Skills Assessment Survey.

ESTABLISHMENT OF CRITERIA

To determine core workplace literacy skills, a set of criteria was used. These were based on the degree of use as indicated by the percentage of affirmative [yes] responses and the frequency of use as indicated by the combined percentage of daily and weekly use.

Critical Workplace Literacy Skills

A skill was deemed critical if the percentage of affirmative responses > 90% and the combined percentage for usage on a daily or weekly basis, > 80%.

Essential Workplace Literacy Skills

If the affirmative response rate was > 75% and the usage was > 65%, then the skill was deemed essential.

Important Workplace Literacy Skills

If the affirmative response rate was > 60% and the usage was > 50%, then the skill was deemed essential.

READING SKILLS

Table 13

JOB SITE READING SKILLS ***Criteria Code*** **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Drawings / Sketches	E^5	C^1	I^1	E^4	C^1	E^1		I^4	I^1	E^3
Production / Work Schedules	E^6	E^8	E^2	E^2	I^3		I^2	I^5		
Specifications	E^2	E^1	E^1	E^3	C^4	E^2		C^7	C^1	E^1
Computer Screen	I^2		C^2		I^2	C^1	C^1	C^1	C^2	C^2
Computer Printouts	I^1		C^3			C^2	I^1	C^3	C^3	C^3
Charts, Tables or Graphs	E^3	E^6	C^5		E^2			I^2	C^4	C^4
Check Lists	E^1	E^4	C^6	E^7	C^2		I^3	C^5		C^5
Memos or Notes	C^2	E^3	C^1	E^5		C^3	C^2	C^2	C^5	C^1
Operating Instructions		E^5		E^6		C^4		C^6	C^6	
Time / Log Sheets	I^3		E^3			E^3		I^6	C^7	C^7
Tool or Equipment Instructions		I^1			I^1					
Manuals	E^4	E^7			E^1			I^1		
Company Rules / Regulations										
Hazard Labels / WHMIS / MSDS				E^8						
Safety Regulations										
Safety Signs / Posters		E^2		C^1	E^3			I^3		C^8
Symbols	C^1	C^2	C^4	E^1	C^3		E^1	C^4	C^8	C^6
Shop Orders										I^1
Mill Specs										
Special Process Reports										I^2
Schematics										
Contracts										
International Documents										
DND Documents										
Commercial Specifications										
CFTO's										
DOT Documents										
E-Mail										
Micro Fiche										
Computer Memos										
Technical Reports										E^2
Technical Journals			I^2					I^7	E^1	E^4

MATHEMATICS SKILLS

Table 14

BASIC MATHEMATICS SKILLS *Criteria Code* C: *critical skills* E: *essential skills* I: *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Add or Subtract Numbers	C^2	E^1	C^2	E^1	C^2	C^1	I^1	C^2	C^1	C^1
Add or Subtract Fractions			I^3					I^3	I^2	E^6
Add or Subtract Decimals	E^1	E^2	E^1	E^3	C^3			C^3	E^1	C^2
Multiply or Divide Numbers	E^3	E^4	E^2	E^4	E^1	E^1	I^2	E^1	E^2	C^3
Multiply or Divide Fractions			I^2			E^2		I^1	I^1	E^5
Multiply or Divide Decimals	E^4	E^3	E^3	E^2	E^2	E^3		E^2	C^2	C^4
Convert Fractions & Decimals	I^2		I^1	I^2	E^3			I^2	E^3	E^4
Count How Many	C^1	C^1	C^1	C^1	C^1	C^2	C^1	C^1	C^3	E^1
Estimate Time	E^2	E^5	C^3	I^1	E^4	C^3	C^2	C^4	C^4	E^2
Estimate Materials	I^1		E^4		E^5	E^4			E^4	E^3

Table 15

TECHNICAL MATHEMATICS SKILLS *Criteria Code* C: *critical skills* E: *essential skills* I: *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Percentage [%]			E^2			E^1			C^1	C^2
Ratios or Proportions			I^1		I^2			I^2	C^3	E^1
Negative Numbers			E^4			E^2		I^1	C^4	
Data	I^1	I^4	E^1		E^1			C^1	C^2	C^1
Graphs, Charts, Tables	E^1	I^1	E^3	I^1	E^3			C^2	C^5	C^3
Statistics			I^3			E^4		I^5	I^2	C^4
Probabilities			I^5			E^5		I^6		
Applied Linear Equations									I^4	
Scientific Notations									I^6	
Scale Drawings	I^6	I^6	I^8		E^7	E^6		I^3	I^3	
Lines and Angles	I^2	I^2	I^4		E^4	E^7		E^3	I^7	E^2
2 Dimensional Shapes	I^5	I^5	I^7		E^6			E^4	I^5	E^3
3 Dimensional Shapes	I^4	I^3	I^9		E^2			E^5		E^4
Estimating Solutions			I^2					I^4	E^2	
Problem Solving	I^3		E^5		I^1			E^1	E^1	
Formulas										I^1
Numerical Specifications	I^7	I^7	I^6		E^5	E^3		E^2	I^1	E^5
Use Concentration Data [p.p.m., g.p.l., etc.]					E^8					

MATHEMATICS SKILLS [cont.]

Table 16

MEASUREMENT SKILLS

Criteria Code
C: *critical skills*
E: *essential skills*
I: *important skills*
[the superscript gives the priority of the skill
i.e.: C^1 is used more frequently than C^2, etc.]

MEASUREMENT SKILLS	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Measure in Imperial	E^1	E^1	E^1	E^1	C^1	E^1		E^1	C^1	E^5
Measure in Metric	I^1		I^1	I^2	C^2	E^2		I^2	E^1	E^2
Convert Imperial & Metric Measures			I^3		I^1	E^3		I^3	I^1	
Volume			I^4			E^4		I^4		E^3
Precision, Accuracy, Tolerance	E^2	C^1	I^2	C^1	I^2	E^5		I^1	I^2	E^1
Radius				I^1					I^3	I^1
Circumference		I^1		I^3					I^4	I^2
Temperature						E^6				E^4
Pressure										E^7
Flow										E^6
Mass\Weight										E^8
Density										I^4
Time									I^5	I^3
Measure Current / Voltage										

Table 17

TOOL SKILLS

Criteria Code
C: *critical skills*
E: *essential skills*
I: *important skills*
[the superscript gives the priority of the skill
i.e.: C^1 is used more frequently than C^2, etc.]

TOOL SKILLS	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Hand Tools	C^2	C^2	C^1	C^2	C^2	C^1	C^1	C^1	C^1	C^1
Tape Measure	C^1	C^1	E^1	C^1	C^1		C^2	E^2	E^2	C^3
Protractor		I^3		I^1	I^4					
Calipers		I^2		I^2	I^3	E^1			I^3	
Scales on Equipment	I^2	E^2	I^1	E^1	E^2				I^2	C^4
Jigs				I^3						
Gauges or Dials on Equipment	I^1	E^1	I^2	E^2	E^1	E^3			I^1	C^5
Calculator	E^1	I^1	E^2	I^3	I^1	C^2	E^1	E^2	E^1	C^2
Computer	I^2		C^2		I^2	C^3	C^2	E^1	C^3	C^2
Advanced Instruments / Instrumentation					E^3	E^2				I^1

COMMUNICATION SKILLS

Table 18

WRITING SKILLS ***Criteria Code*** **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Fill in Forms	E^1	E^1	C^1		E^1	C^1	E^1	C^1	C^1	C^1
Fill in Time Cards			I^1					I^1	E^1	E^2
Keep Track of Hours	I^1	I^2		I^3			I^2	E^3	C^2	C^2
Write Shift Reports		E^2	E^1	I^1	E^2					I^1
Leave Notes / Memos	E^2						E^2	E^2	C^6	C^3
Write Work Orders			C^2		I^2					I^2
Write Incident Reports										
Write Instructions	I^2						E^3		C^4	C^4
Make Drawing / Sketches	E^3	I^1	C^4		I^1	E^1		E^4	E^1	E^1
Write Letters / Reports			I^2				I^1	E^1	C^5	
Write Safety Reports			I^3			E^2				
Shop Queries			C^3							
E-Mail										
Input Data on Computer							C^1	C^2	C^3	E^3

Table 19

ORAL SKILLS ***Criteria Code*** **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Follow Verbal Directions	C^2	C^1	C^3	C^1	C^1	C^2	C^5	C^1	C^5	C^1
Give Verbal Directions	E^3	E^3	C^4	I^1	E^1		C^6	E^1	C^6	C^2
Follow Written Directions	E^1	E^1	C^1	E^3	C^2	C^1	C^4	C^4		
Give Written Directions	I^1		E^1		I^1		I^3	E^2	C^4	
Ask Questions	C^1						C^1	C^2	C^1	C^3
Take Messages	C^3	E^2	C^2	E^1	C^3	C^3	C^2	C^5	C^2	C^4
Speak in Large Groups			I^2			E^1				
Speak in Small Groups						C^4			E^1	E^2
Speak with Outside People [eg.suppliers]							I^1			E^3
Participate in Meetings			I^1						C^7	C^5
Use the Telephone	E^2						C^3	C^3	C^3	E^1

COMMUNICATION SKILLS [cont.]

Table 20

COMMUNICATION TOOL SKILLS *Criteria Code* **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Use the Typewriter										
Use the Fax Machine			E^1					I^2		E^1
Use the Photocopier	E^1	I^2	C^1	I^3	I^1	C^1	C^1	C^2	C^1	C^1
Use Hand Signals										
Use 2 Way Radio										
Use Mainframe Computer			C^2			E^1	C^2	C^1	C^2	C^3
Use Process Control Computer										
Use a Personal Desktop Computer			C^4				E^1	C^3	E^1	C^2
Use a Portable Computer										
Use a Modem										
Use Remote Control Radio Equipment										
Coordinate Work With Other Groups	I^1	I^1	C^3	I^1		E^2	E^2	C^4		C^4
Work with Trade Groups		E^1	I^1	E^1	E^1			I^1		E^2

Table 21

SOCIAL SKILLS *Criteria Code* **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Work by yourself	I^1		C^1	E^1	C^1	C^1	C^1	C^1	C^1	C^1
Work with a partner or helper			I^1	E^2		E^1			E^1	
Work as a member of a team			E^1				I^1	E^1	I^1	E^1

PRODUCTIVE THINKING SKILLS

Table 22

INFORMATION PROCESSING SKILLS *Criteria Code* **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^{1} is used more frequently than C^{2}, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Process information in a variety of ways	I^{1}	•	E^{2}			C^{1}	E^{1}	E^{1}	E^{1}	C^{6}
Research information or data	I^{3}		E^{3}			E^{1}	I^{1}	E^{2}	C^{1}	C^{7}
Analyze information or data	I^{4}		E^{1}				I^{5}	E^{3}	C^{2}	C^{3}
Design systems			E^{11}					E^{8}	E^{2}	C^{4}
Design products						E^{3}			I^{1}	E^{8}
Engineer solutions			E^{6}				I^{10}	E^{10}	C^{8}	E^{1}
Perform system analysis[trouble shooting]	I^{11}		I^{1}			E^{2}		E^{9}	E^{3}	C^{1}
Perform technological assessments			C^{1}			E^{4}				C^{2}
Identify inconsistencies, deficiencies, and contradictions	I^{6}		E^{8}			E^{5}	E^{2}	I^{1}	C^{9}	E^{3}
Make inferences	I^{2}		E^{16}		I^{1}	E^{6}	I^{8}	E^{17}	C^{14}	E^{4}
Identify main ideas			E^{17}			E^{7}	I^{7}	E^{11}	C^{10}	E^{6}
Summarize and condense information, facts	I^{12}		E^{12}				I^{2}	E^{12}	C^{3}	E^{2}
Note similarities and differences between facts	I^{13}		E^{13}			E^{8}	I^{6}	E^{13}	C^{11}	C^{8}
Classify facts			E^{15}			E^{9}		E^{16}	C^{4}	E^{5}
Identify stated and unstated reasons	I^{9}		E^{4}			E^{10}	E^{3}	E^{14}	C^{12}	C^{5}
Recognize associations and connects information	I^{8}		E^{9}			E^{11}	I^{9}	E^{4}	C^{13}	C^{9}
Form conclusions and generalizations from facts	I^{5}		E^{5}				I^{3}	E^{15}	C^{5}	C^{10}
Make predictions on the basis of patterns in data	I^{14}		E^{14}					E^{7}	E^{4}	C^{11}
Evaluate info. according to set criteria	I^{10}		E^{10}					E^{6}	C^{6}	C^{12}
Make decisions based on information supplied by others	I^{7}	E^{7}					I^{4}	E^{5}	C^{7}	E^{7}

PRODUCTIVE THINKING SKILLS [cont.]

Table 23

JUDGMENT & DECISION SKILLS *Criteria Code* **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Identify facts, opinions, and reasoned arguments	I^7		E^7			E^1	I^5	E^5	C^5	C^2
Recognize evidence and check it	I^3		E^4			E^2	E^1	E^6	C^6	C^4
Deal with differing value systems	I^2		E^6		I^1	E^3	I^1	E^3	C^7	
Distinguish between valid and questionable assumptions	I^1		C^1				I^2	E^1	C^2	C^1
Spot inconsistencies and gaps in information	I^4		E^1				E^2	E^2	C^8	C^3
Gather and organize data	I^6		E^2			C^1	I^3	E^7	C^1	C^6
Decide whether statements contradict each other	I^8		E^3				E^3	I^1	C^3	C^6
Evaluate others judgments	I^5		E^5			E^4	I^4	E^4	C^4	

Table 24

PROBLEM SOLVING SKILLS *Criteria Code* **C:** *critical skills* **E:** *essential skills* **I:** *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Solve problems on your own	I^1		E^1			E^4	E^1	E^1	E^1	E^1
Solve problems as a member of a team			E^{14}				I^{11}	I^3	E^{16}	E^{14}
Identify general problems	I^4		E^4			C^1	I^3	E^3	E^2	E^4
Determine the attributes of a problem	I^2		E^5			C^2	I^4	E^4	E^3	E^5
Clarify the problem for others	I^3		E^3			C^3	I^5	E^2	E^4	E^6
Formulate questions about the problem	I^5		E^7			C^4	I^6	E^6	E^5	E^7
Formulate hypotheses for testing			I^2			E^1		I^7	E^{15}	E^{13}
Evaluate hypotheses			I^1			E^2			E^8	E^{14}
Figure out experiments to test hypotheses			I^3			E^3			E^9	E^{15}
Integrate info. about the problem			E^{12}				I^{12}	I^4	E^6	E^8
Formulate solutions	I^7		E^8			C^5	I^7	E^7	E^7	E^9
Examine and rank solutions	I^8		E^9				I^8	E^8	E^{11}	E^{10}
Choose solutions as an individual	I^6		E^6			C^6	I^1	I^1	E^{12}	E^2
Choose solutions as a member of a team			E^{13}			E^5	I^9	I^5	E^{17}	E^{17}
Direct others in the application of the solution	I^9		E^2				I^{10}	E^5	E^{14}	E^3
Seek acceptance of solutions			E^{10}			C^7	I^{12}	I^6	E^{10}	E^{11}
Monitor solutions			E^{11}			C^8	I^{13}	I^2	E^{13}	E^{12}

PRODUCTIVE THINKING SKILLS [cont.]

Table 25

FORMAL REASONING, CRITICAL THINKING, & LOGIC SKILLS *Criteria Code* C: *critical skills* E: *essential skills* I: *important skills* [the superscript gives the priority of the skill i.e.: C^1 is used more frequently than C^2, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Determine the meaning of terms and statements	I^3		E^1			C^2	E^5	E^4	C^2	C^2
Notice qualities of things: how things differ or are alike	I^1		E^2				E^1	E^5	C^3	C^3
Notice successive stages in which things occur	I^6		E^9				I^5	I^1	C^4	C^4
Break down wholes into component parts	I^9		E^7			E^1	I^1	E^6	C^5	C^5
Identify and sort things into classes	I^7		E^3				I^2	E^2	C^6	C^6
Recognize analogies and reason by analogy	I^{14}		E^5				E^2	E^{14}	C^7	C^7
Represent ideas as three-dimensional images									E^2	C^{16}
Judge the credibility of sources	I^5		C^2				E^6	E^7	C^1	C^8
Detect bias, stereotypes	I^{13}		E^{12}				I^7	E^3	E^1	C^9
Distinguish relevant from irrelevant data	I^4		E^4				I^3	E^1	C^{10}	C^{10}
Distinguish fact from opinion	I^2		C^1			C^1	E^3	E^8	C^{11}	C^{11}
Connect causes and effects			E^{13}			E^2		E^9	C^{12}	C^{12}
Use scientific method as a process of validation			E^{14}			E^3				
Use evidence to examine the validity of beliefs	I^{12}		I^1				I^8	E^{13}	C^8	C^1
Examine arguments for ambiguity in the line of reasoning and for contradictory statements	I^{15}		E^6			E^4	E^7	I^2		C^1
Judge whether a definition is adequate, an assumption is correct, and a conclusion is possible, valid or necessary	I^8		E^8				E^4	E^{10}	C^9	C^{13}
Use syllogistic reasoning	I^{10}		E^{11}			E^5	I^4	E^{11}	C^{14}	C^{14}
Analyze and evaluate arguments	I^{11}		E^{10}				I^6	E^{12}	C^{13}	C^{15}

PRODUCTIVE THINKING SKILLS [cont.]

Table 26

CREATIVE THINKING SKILLS *Criteria Code* C: *critical skills* E: *essential skills* I: *important skills* [the superscript gives the priority of the skill i.e.: C^{1} is used more frequently than C^{2}, etc.]	Total Workforce	Hourly Workforce	Salaried Workforce	Skilled Manual	Skilled Craftsperson	Supervisor	Clerical/Sales	Technical	Professional	Management
Analyzes open-ended situations and problems and restates, reorganizes, or breaks down the problem	E^{5}		C^{7}	I^{6}	I^{4}		C^{3}	C^{10}	C^{6}	E^{1}
Lists attributes of objects and situations	E^{10}		C^{10}	I^{11}	I^{7}		I^{1}	C^{6}	C^{7}	C^{2}
Generates ideas	E^{2}		C^{3}	I^{4}	I^{1}		C^{4}	C^{7}	C^{4}	C^{3}
Generates multiple ideas to support multiple viewpoint on the same issue	I^{4}		E^{1}		I^{12}	E^{1}			C^{8}	C^{13}
Identifies and examines alternatives	E^{8}		C^{2}	I^{7}	I^{9}		C^{5}	C^{1}	C^{5}	C^{4}
Ranks alternatives and chooses the best	E^{11}		C^{4}		I^{8}		C^{6}	C^{2}	C^{10}	C^{5}
Uses insight	E^{3}		C^{6}	I^{3}	I^{2}	E^{2}	C^{7}	C^{3}	C^{11}	C^{6}
Uses intuition	E^{1}		C^{1}	I^{1}	I^{5}	C^{1}	C^{1}	C^{4}	C^{2}	C^{7}
Identifies relationships between situations that may appear unconnected	E^{7}		C^{11}	I^{8}	E^{1}		E^{1}	C^{11}	C^{14}	C^{8}
Makes unusual connections between facts	E^{6}		C^{12}	I^{5}	I^{6}		E^{2}	C^{13}	C^{12}	C^{9}
Tolerate ambiguity, hold conclusion off to search for innovative ideas	E^{12}			I^{10}			I^{2}		C^{3}	E^{2}
Elaborates details	I^{1}		C^{13}	I^{12}	I^{13}	E^{3}	E^{4}	C^{5}	I^{1}	C^{1}
Synthesizes from various sources to form a new whole	I^{2}		C^{9}				E^{5}	C^{8}	C^{9}	C^{14}
Extrapolates from limited facts	E^{9}		C^{5}	I^{9}	I^{10}		E^{6}	C^{12}	C^{1}	C^{10}
Uses imagery	E^{4}		C^{8}	I^{2}	I^{3}	C^{2}	C^{2}	C^{9}	E^{1}	C^{11}
Uses metacognition	I^{3}		C^{14}		I^{11}		E^{3}	I^{1}	C^{13}	C^{12}
Uses metadata			E^{2}						E^{2}	

SURVEY RESULTS PART 3

WORKPLACE MATERIALS READABILITY

The written word is the most common form of information transmittal between all divisions of the industry, between management and labor, and between individual workers and work groups. The level of readability of instructions, regulations, procedures, reports, memos, and general workplace literature impacts directly on the workers ability to comprehend the message.

DATA COLLECTION

During the course of work area tours and the interview portion of the project the consultant collected representative samples of workplace documents. Five examples of general workplace documents, five company/employee forms, and five documents from each work category[skilled manual, technical, management etc.] were collected. Portions of the documents were copied into Microsoft word and the grammar checker sub program employed to analyze the readability of the document

DATA ANALYSIS

Readability Statistics

Averages

Displays the average number of sentences per paragraph, words per sentence, and characters per word.

Readability

Displays the percentage of sentences written in passive voice, as well as other readability indexes.

Passive Sentences

Displays the percentage of sentences written in passive voice.

Flesch Reading Ease

Computes readability based on the average number of syllables per word and the average number of words per sentence. Scores range from 0 (zero) to 100. Standard writing averages approximately 60 to 70. The higher the score, the greater the number of people who can readily understand the document.

Flesch-Kincaid Grade Level

Computes readability based on the average number of syllables per word and the average number of words per sentence. The score in this case indicates a grade-school level. For example, a score of 8.0 means that an eighth grader would understand the document. Standard writing approximately equates to the seventh-to-eighth-grade level.

DATA ANALYSIS [cont.]

Coleman-Liau Grade Level

Uses word length in characters and sentence length in words to determine a grade level.

Bormuth Grade Level

Uses word length in characters and sentence length in words to determine a grade level.

The readability statistics are summarized at the conclusion of each table based on the following summary.

Flesch Reading Ease =	Flesch Grade Level =	Reading Ease
90-100	4	Very Easy
80-90	5	Easy
70-80	6	Fairly Easy
60-70	7-8	Standard
50-60	9-10	Fairly Difficult
30-50	11-14	Difficult
0-30	15-16	Very Difficult

MATERIALS READABILITY ASSESSMENT RESULTS

Table 27

General Documents	Company Newsletter	Union Newsletter	Collective Agreement	Management Memo	Corporate Publication
Averages					
Sentences per paragraph	4.5	5.0	0.6	1.2	1.6
Words per sentence	21.0	21.4	52.0	16.0	12.4
Characters per word	5.1	4.6	5.3	5.1	4.2
Readability					
Passive Sentences	33%	10%	33%	0%	26%
Flesch Reading Ease	48.1	59.0	35.9	49.6	31.7
Flesch-Kincaid Grade Level	11.8	10.2	14.5	10.2	11.8
Coleman-Liau Grade Level	12.6	10.6	49.2	13.5	14.3
Bormuth Grade Level	10.6	10.3	10.7	10.6	10.4
Assessment	Difficult	Fairly Difficult	Difficult	Difficult	Difficult

MATERIALS READABILITY ASSESSMENT RESULTS [cont.]

Table 28

Company Forms	**Investment Options**	**Application for Assistance**	**Job Description**	**Eligibility Requirements**	**Educational Assistance**
Averages					
Sentences per paragraph	1.8	1.0	1.5	1.1	1.0
Words per sentence	19.0	29.3	16.8	13.3	13.6
Characters per word	4.9	4.5	6.0	6.1	5.8
Readability					
Passive Sentences	28%	50%	16%	20%	42%
Flesch Reading Ease	53.2	55.5	15.7	20.5	25.9
Flesch-Kincaid Grade Level	10.3	10.2	14.8	13.7	13.5
Coleman-Liau Grade Level	14.4	26.0	21.6	18.4	19.3
Bormuth Grade Level	11.2	11.6	11.5	11.1	11.5
Assessment	**Fairly Difficult**	**Fairly Difficult**	**Very Difficult**	**Very Difficult**	**Very Difficult**

Table 29

Skilled Manual	**WHMIS. Employee**	**Test**	**Shop Order**	**Operating Procedure**	**Operational Instructions**
Averages					
Sentences per paragraph	0.5	2.0	0.3	3.5	2.0
Words per sentence	40.3	16.8	20.8	20.0	15.8
Characters per word	5.9	5.1	3.2	4.3	5.7
Readability					
Passive Sentences	33%	25%	25%	0%	50%
Flesch Reading Ease	0.0	68.0	107.4	69.7	47.4
Flesch-Kincaid Grade Level	21.7	7.8	1.0	8.4	9.7
Coleman-Liau Grade Level	24.5	13.1	26.1	11.6	16.7
Bormuth Grade Level	10.7	10.6	11.1	10.6	10.8
Assessment	**Very Difficult**	**Standard**	**Very Easy**	**Standard**	**Difficult**

Table 30

Skilled Craftsperson	**Shop Order**	**Operations Sheet**	**Shop Query**	**Engineering Change Notice**	**Engineering Memo**
Averages					
Sentences per paragraph	0.8	0.7	2.3	1.0	1.0
Words per sentence	15.4	34.3	9.6	26.2	24.8
Characters per word	4.6	4.5	4.2	4.5	5.8
Readability					
Passive Sentences	20%	0%	11%	80%	50%
Flesch Reading Ease	82.8	55.6	75.5	61.2	35.7
Flesch-Kincaid Grade Level	5.2	8.6	5.0	10.4	14.2
Coleman-Liau Grade Level	14.4	53.0	7.8	15.4	19.1
Bormuth Grade Level	10.9	11.6	8.5	11.5	11.6
Assessment	**Difficult**	**Fairly Difficult**	**Fairly Easy**	**Fairly Difficult**	**Difficult**

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MATERIALS READABILITY ASSESSMENT RESULTS [cont.]

Table 31

Supervisor	Operating Instructions	Memo	Technical Inquir	Operations Sheet	Shop Order
Averages					
Sentences per paragraph	3.0	1.3	1.0	2.3	3.2
Words per sentence	21.8	17.4	12.5	13.0	6.8
Characters per word	4.9	4.8	4.9	3.9	3.2
Readability					
Passive Sentences	83%	20%	50%	14%	30%
Flesch Reading Ease	53.2	54.6	59.1	89.4	92.2
Flesch-Kincaid Grade Level	11.2	9.9	7.9	4.0	1.0
Coleman-Liau Grade Level	13.3	11.4	13.6	6.6	26.1
Bormuth Grade Level	10.9	10.3	10.5	8.9	11.1
Assessment	**Fairly Difficult**	**Fairly Difficult**	**Fairly Difficult**	**Easy**	**Very Easy**

Table 32

Clerical/Sales	Meeting Minutes	Contract Law	Contract	Schedule	Consultants Report
Averages					
Sentences per paragraph	0.7	2.3	1.5	0.9	3.0
Words per sentence	18.9	28.7	37.0	20.5	21.9
Characters per word	5.1	5.2	5.1	4.3	4.8
Readability					
Passive Sentences	25%	57%	0%	16%	11%
Flesch Reading Ease	48.5	34.6	22.2	61.5	53.3
Flesch-Kincaid Grade Level	9.9	13.5	19.1	9.0	8.2
Coleman-Liau Grade Level	19.6	27.0	14.5	14.1	42.8
Bormuth Grade Level	11.1	11.6	10.9	10.6	11.5
Assessment	**Difficult**	**Difficult**	**Very Difficult**	**Standard**	**Fairly Difficult**

Table 33

Technical	Military Specifications	Technical Manua	Operations Sheet	Engineering Report	Schedule
Averages					
Sentences per paragraph	1.0	1.7	0.4	0.4	12.0
Words per sentence	37.3	14.0	31.0	42.5	18.9
Characters per word	4.4	6.0	4.2	6.2	5.2
Readability					
Passive Sentences	66%	20%	0%	0%	25%
Flesch Reading Ease	60.7	28.6	88.3	0.0	48.1
Flesch-Kincaid Grade Level	9.7	12.1	3.1	25.5	11.2
Coleman-Liau Grade Level	33.6	17.8	56.4	23.0	13.6
Bormuth Grade Level	11.5	10.8	11.5	10.7	10.9
Assessment	**Standard**	**Very Difficult**	**Very Easy**	**Very Difficult**	**Difficult**

MATERIALS READABILITY ASSESSMENT RESULTS [cont.]

Table 34

Professional	Instructional Report	Engineering Report	DND Document	Operations Procedure	Engineering Memo
Averages					
Sentences per paragraph	1.8	1.8	1.5	2.7	2.0
Words per sentence	16.0	15.0	21.7	14.5	15.5
Characters per word	4.5	4.2	5.5	4.6	5.4
Readability					
Passive Sentences	42%	44%	50%	25%	66%
Flesch Reading Ease	75.7	77.7	36.8	82.1	52.5
Flesch-Kincaid Grade Level	6.1	5.9	13.2	5.2	9.7
Coleman-Liau Grade Level	13.7	10.0	17.4	12.0	16.4
Bormuth Grade Level	10.2	9.5	11.6	9.8	11.1
Assessment	**Fairly Easy**	**Fairly Easy**	**Difficult**	**Easy**	**Fairly Difficult**

Table 35

Management	Proposal	Discussion Sheet	Project Report	Corporate Directive	WHMIS Executive
Averages					
Sentences per paragraph	5.5	2.0	12.0	3.5	2.0
Words per sentence	17.8	15.4	18.9	20.0	21.2
Characters per word	5.4	5.1	5.2	4.3	5.0
Readability					
Passive Sentences	36%	50%	25%	38%	33%
Flesch Reading Ease	38.0	59.9	48.5	68.0	0.0
Flesch-Kincaid Grade Level	12.3	8.4	9.9	7.8	21.7
Coleman-Liau Grade Level	14.9	15.7	19.6	13.1	24.5
Bormuth Grade Level	11.2	11.1	11.1	10.6	10.7
Assessment	**Difficult**	**Fairly Difficult**	**Difficult**	**Standard**	**Very Difficult**

CONCLUSIONS

DEMOGRAPHIC BACKGROUND

- 84.00% of participants were male, 16.00% female
- 32.00% of participants are aged 34 to 42 years, this represents the largest single age group
- 41.60% of participants are over the age of 40.
- 16.00% of participants claim a first language other than French or English.
- 16.00% of participants read and write languages other than French or English.
- 19.20% of participants have held their current job classification for less than 2 years.
- 14.40% of participants have been in the aerospace industry for less than 5 years.
- 14.40% of participants have been in the aerospace industry for more than 20 plus years.

EDUCATION

Location of Educational Experience:

- 48.80% of the total workforce were educated in Winnipeg.
- 65.60% of the total workforce were educated in Manitoba.
- 12.00% of the total workforce were educated in other Canadian provinces.
- 77.00% of the total workforce were educated in Canada.
- 23.00% of the total workforce were educated in countries other than Canada.

Secondary Schooling:

- 2.40% of the total workforce [4.17% of the hourly workforce] completed grade 8.
- 67.00% of the total workforce completed grade 12.
- 29.60% of the total workforce [34.72% of the hourly workforce] completed some form of pre-apprenticeship training.
- 7.20% of the total workforce [9.72% of the hourly workforce] completed an apprenticeship.
- 21.60% of the total workforce [33.96% of the salaried workforce] completed a 2 year certificate or diploma program.
- 11.20% of the total workforce [22.64% of the salaried workforce] completed a 4 year degree program.

EDUCATION [cont.]

Learning Preferences

- 57.60% to 68.00% of the total workforce would like to attend ***basic reading, writing, math, or speaking courses***.
- 64.80% of the total workforce would prefer to attend educational courses ***presented on the jobsite***.
- 75.20% of the total workforce would prefer to attend educational courses in a ***classroom setting***.
- 66.40% of the total workforce would prefer to attend educational courses in the ***middle of the workweek***.

Skills Acquisition

- 37.60% of the total workforce rate ***computer data management*** as a desirable skill to obtain based on their work experience.
- 36.80% of the total workforce rate ***problem solving*** as a desirable skill to obtain based on their work experience.
- 35.20% of the total workforce rate ***communications*** as a desirable skill to obtain based on their work experience.
- 33.60% of the total workforce rate ***computer programming*** as a desirable skill to obtain based on their work experience.
- 30.40% of the total workforce rate ***computer numerical control*** as a desirable skill to obtain based on their work experience.
- 29.60% of the total workforce rate ***study skills*** as desirable skills to obtain based on their work experience.
- 28.80% of the total workforce rate ***drafting/print reading*** as a desirable skill to obtain based on their work experience.
- 25.60% of the total workforce rate ***technical writing*** as a desirable skill to obtain based on their work experience.

CORE WORKPLACE SKILLS

The following skills have been deemed critical, essential, or important to the performance of job tasks or duties by a majority of the workforce. [see page for definition of criteria]

Reading Skills

- Work area reading skills; drawings and sketches, production/work schedules, specifications, computer screens and printouts, charts, tables and graphs, check lists, memos and notes, time/log sheets, manuals, and symbols, reading materials that reflect directly on the specific work area and day to day performance of the worker.
- Company and union reading materials rank as essential when frequency of use is adjusted to include monthly frequency.

Mathematics Skills

- Basic mathematics; the addition, subtraction, multiplication and division of whole numbers and decimals, as well as estimation skills.
- Technical mathematics; graphs, charts, tables, scale drawings, lines and angles, 2 and 3 dimensional shapes, problem solving, and numerical specifications.
- Measurement skills and the development of precision, accuracy, and a understanding of the application of tolerances.
- Hand tools; tape measures, scales, gauges and dials, calculators, and computers.

Communication Skills

- Writing skills; filling in forms, keeping track of hours, notes and memos, instructions, and making drawings or sketches.
- Oral skills; the ability to give and follow written or verbal directions, ask questions, take messages, and use the telephone.
- Communication tools; the use of the mainframe or personal computer, photocopier, the ability to coordinate work groups and work with trade groups.
- Social skills; the ability to work independently is important to the total workforce, teamwork is an essential skill to the salaried workforce.

CORE WORKPLACE SKILLS [cont.]

Productive Thinking Skills

- Information processing skills; research and information analysis, systems analysis [trouble shooting], identifying deficiencies, summarizing and condensing information, recognizing associations, forming conclusions, making predictions, and decision making.
- Judgment and decision making skills; identifying facts, recognizing evidence, organization of data, and evaluating judgments.
- Problem solving skills; independent problem solving, identification and clarification of problems, formulating solutions, and directing others in the application of solutions.
- Formal reasoning, critical thinking, and logic skills; determining meanings, noticing qualities and stages of things, breaking down and sorting components, judging credibility, detecting bias, distinguishing relevance, using evidence, analyzing and evaluating, and using syllogistic reasoning [deductive reasoning].
- Creative thinking skills; analyzing open-ended situations, generating ideas, examining alternatives, ranking alternatives, using insight and intuition, identifying relationships, elaborating details, synthesis, extrapolating, using imagery, and using metacognitive processes [thinking about one's own thinking].

MATERIAL READABILITY ASSESSMENT

- General company / union documents and government documents would appear to be overly complicated in language, structure and presentation format
- Documents range from very easy to very difficult in readability throughout the workforce with little correlation to educational background of the writer or intended reader.

RECOMMENDATIONS

GENERAL RECOMMENDATIONS

- That a distinction be made between the teaching of basic skills and task specific training traditionally offered the hourly workforce.
- That the existing employer/employee relationship be broadened to encourage a learning continuum for all.
- That a data base of available community resources be compiled and made available to the workforce.
- That the inclusion and success of all workers be a priority in the development and delivery of programs.
- That the inclusion of an English as a second language component be a priority in program development.

CURRICULUM DEVELOPMENT

- That a teaching philosophy be implemented in the development and presentation of all courses
- That all curriculum development be constructed utilizing a lifelong learning approach to basic skills development.
- That general industry specific basic skills courses be developed using general contextual materials.
- That work area contextual courses be developed to address the needs of individual work groups.
- That an educational technology specialist be employed or contracted to develop a short and long term industry specific Basic Skills Curriculum and delivery strategy.
- That all courses be designed to be implemented in the workplace and allow for the participation of all workers.
- That all courses utilize materials that are clearly relevant to the workplace or employment issues.
- That a communications strategy be developed and implemented to address the gap evident within the company. Communication skills can only be utilized if well defined avenues exist for there use.

PROGRAM DELIVERY

General Observations

- That an in house classroom facility be developed for the presentation of courses, and that course specialists be brought in to present materials as opposed to sending workers to outside learning facilities, thus fostering a learning environment and mentality within the company and workforce.
- That computer assisted courseware be utilized to introduce and develop computer skills throughout the workforce.

Computer Assisted Courseware

- With the acquisition of basic computer skills being requested as a priority course by the survey participants, the conclusion can be made that if an introductory computer skills tutorial is used as an introduction to other skill topics, a degree of participant motivation would be built into the basic skills curriculum.

Consultants Comments:

Computer assisted learning offers an approach to basic skills development & upgrading that can provide generic introductory material as well as be adapted to provide contextual instruction. Adult learners often prefer the privacy and self controlled pace of these learning systems.

The graphical nature of the Windows 3.1 operating system for IBM based systems is extremely useful as a presentation medium and with the development of multi-media CD Rom systems, sound and video can be incorporated into tutorials providing a degree of familiarity while providing learners with a dramatic interesting learning package.

Computer assisted learning systems can be programmed to quiz learners at critical intervals in course content, can record results, and provide easy access to data allowing the learner to visually track their own progress. If learning systems are integrated into main frame and desktop networks all ready in place, or planed for the workplace, the curriculum could be accessible to a multitude learners at a variety of times and locations.

COURSE DEVELOPMENT

- That courses in basic reading, writing, math, communications, problem solving and teamwork skills be offered to all employees in the workplace.
- Industry, company, and work area contextual courses, should be developed with attention given to the following skills areas:

Reading Courses:

- Basic reading strategies
- Interpreting technical materials
- Interpreting drawings and sketches
- Interpreting schedules
- Interpreting charts, tables and graphs
- Understanding company documents and document systems
- Filling in forms
- Using technical terminology [when and why]
- Interpreting employment materials: collective agreement, benefits and deductions, etc.

Math:

- Basic mathematics
- Imperial and metric measurements
- Interpreting numerical specifications
- Estimating
- Interpreting gauges, dials and readouts
- Measurement systems and tools
- Using calculators
- Statistical analysis

Computer Courses:

- Basic introduction to computers
- Word processing
- Developing presentations
- Using project management software
- Creating charts and graphs
- Using computer communications technologies

Communications:

- Basic writing skills
- Technical writing
- Plain language writing
- Drawing and sketching
- Form development
- Giving and receiving directions and instructions
- Using communication technologies
- Teamwork

Productive Thinking:

- Basic information processing systems
- Basic problem solving strategies
- Team problem solving strategies
- Systems analysis
- Decision making
- Assessment strategies
- Evaluation methodologies
- Deductive reasoning strategies

APPENDICES

SURVEY INTERVIEW FORM

WORKPLACE EDUCATION MANITOBA
ORGANIZATIONAL NEEDS ASSESSMENT
MANITOBA AEROSPACE SECTOR
PART A - BACKGROUND INFORMATION

1. Gender Male ☐ Female ☐
2. Age 16-24 ☐; 25-33 ☐; 34-42 ☐; 43-50 ☐; 50+ ☐
3. First Language English ☐ French ☐ Other ☐
4. Do you read English ☐ French ☐ Other ☐
5. Do you write English ☐ French ☐ Other ☐
6. Do you speak any other language in your home ☐

7. What is the main area of the aerospace industry you work in?

Management		Supervisor/Foreperson		Skilled Manual	
Professional		Clerical/Sales		Manual	
Technical		Skilled Craftsperson/Trades		Other	

8. What is your job title?
9. How long have you held this position? 1-2 ☐ 3-5☐ 6-10☐ 11-15☐ 20+☐
10. What was your previous job?
11. How long did you have that position?
12. How long have you worked in the aerospace industry? 1-2 ☐ 3-5☐ 6-10☐ 11-15☐ 20+☐
13. Occupation before entering the aerospace industry?

PART B EDUCATION

1. Where did you go to school?

WINNIPEG ☐	BRANDON ☐	PORTAGE ☐	OTHER ☐	WHERE:

2. What is the highest level of schooling you have completed?

less than grade 8		grade 12		complete 2 year certificate or diploma	
grade 8		high school diploma		complete 4 year degree [bachelors]	
grade 9		Pre-apprenticeship		more than 4 years of university	
grade 10		Apprenticeship		other	
grade 11		Trade upgrading			

3. If you hold a University degree, a diploma, or certificate which one?
4. Including high school and beyond, which courses have you completed in the following subject areas?

General Math		Drafting / Print Reading		Co-op Work Experience	
Algebra		Metalworking		Business	
Geometry		Electricity		Typing	
Trigonometry		Electronics		Computers	
Calculus		Power[hydraulics/pneumatics]		Writing Skills	
Statistics		Cad / Cam		Personal Communications	
General Science		Shop Math		English as a second language	
Chemistry		Technical Writing		Reading Improvement	
Physics		Problem Solving		Other	
Technology		Pre Apprenticeship			

5. Which courses would you like to take or review again if you had the chance based on your work experience?

Algebra		Chemistry		Computer Data Management	
General Math		Physics		Computer Numerical Control	
Geometry		Drafting / Print Reading		Computer Programming	
Shop Math		Technical Writing		Problem Solving	
Trigonometry		Metalworking		Study Skills	
Calculus		Electricity		Communications	
Statistics		Electronics		Basic Writing, Spelling, Reading	
General Science		Power[auto/hydraulics/pneumatics]		Others:	

Have you taken any courses offered by the Union / Labor Relations Association? No ☐ What kind?
Have you received any training offered by an employer? No ☐ What kind?
Have you taken any course on your own, night school, community college, etc.? No ☐ What kind?
Do you have any trade papers or tickets? No ☐ What kind?

10. Would you like to take a course to upgrade your basic

READING SKILLS ..... ☐	WRITING SKILLS ..... ☐	MATH SKILLS .... ☐	SPEAKING SKILLS ☐

11. What specific types of courses would benefit you in your present position, or in regard to positions you aspire to?

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SURVEY INTERVIEW FORM [cont.]

PART C BASIC JOB SITE SKILLS

READING SKILLS

1. JOB SITE

Do you read?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Drawings / Sketches						
Permits						
Production / Work Schedules						
Specifications						
Computer Screen						
Computer Printouts						
Charts, Tables or Graphs						
Check Lists						
Memos or Notes						
Operating Instructions						
Time / Log Sheets						
Tool or Equipment Instructions						
Manuals						
Company Rules / Regulations						
Hazard Labels / WHMIS / MSDS						
Safety Regulations						
Safety Signs / Posters						
Symbols						
Shop Orders						
Mil Specs						
Special Process Reports						
Schematics						
Contracts						
International Documents						
DND Documents						
Commercial Specifications						
CFTO's						
DOT Documents						
E-Mail						
Micro Fiche						
Computer Menus						
Technical Reports						
Technical Journals						
Technical Literature						
Process Improvement Team Minutes						

2. COMPANY / UNION MATERIAL

Do you read ?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Collective Agreement						
Safety & Health Minutes						
Pension Information						
Constitution & Bylaws [Union]						
Training Material						
Workplace Safety & Health Act						
Shareholders Report						
Benefits Statement						
Budgets / Costs						
Monthly reports from Other Work Areas						
Background Information Other Areas						
Annual Report						
Union Newsletter.						
Company Newsletter						

3. Please list any other kinds of reading you do on the job.

Are you comfortable with what you read on the job? Yes ☐ No ☐ Sometimes ☐

5. What reading materials in your opinion should \ could be made clearer?

6. PERSONAL READING SKILLS

Do you read?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Newspapers						
Magazines						
Professional Journals						
Light books [novels, self help, how to]						
Non fiction titles						
Textbooks						
Religious materials						
Children's school materials						
comic books						

9: As a reader, do you consider yourself to be:

☐	Average ☐	ge ☐	e Average ☐	lent ☐

SURVEY INTERVIEW FORM [cont.]

II: MATHEMATICS SKILLS

1: BASIC MATH:

On the job do you?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Add or Subtract Numbers						
Add or Subtract Fractions						
Add or Subtract Decimals						
Multiply or Divide Numbers						
Multiply or Divide Fractions						
Multiply or Divide Decimals						
Convert Fractions & Decimals						
Count How Many						
Estimate Time						
Estimate Materials						

2: TECHNICAL MATH:

On the job do you use?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Percentage [%]						
Ratios or Proportions						
Negative Numbers						
Bend Allowances						
Data						
Graphs, Charts, Tables						
Statistics						
Probabilities						
Trigonometric Functions						
Right Triangle Relationships						
Applied Linear Equations						
Applied Non Linear Equations						
Uses of Powers and Roots						
Scientific Notations						
Signed Numbers and Vectors						
Scale Drawings						
Lines and Angles						
2 Dimensional Shapes						
3 Dimensional Shapes						
Estimating Solutions						
Problem Solving						
Chemical Proportions						
Formulas						
Convert Hex to Decimal						
Numerical Specifications						
Use Concentration Data [p.p.m., g.p.l., etc.]						

3: Please list any other kinds of mathematics you use on the job.

4: MEASUREMENT SKILLS:

Do you work with?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Measure in Imperial						
Measure in Metric						
Convert Imperial & Metric Measures						
Volume						
Precision, Accuracy, Tolerance						
Radius						
Circumference						
Temperature						
Pressure						
Flow						
Mass\Weight						
Acceleration						
Density						
Time						
Stress						
Tension						
Optical units						
pH						
Fuel in lb.						
Capacitance						
Resistance						
Conductivity						
Measure Current / Voltage						
Millivolts/ Milliamps						
Productivity						

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SURVEY INTERVIEW FORM [cont.]

5: Please list any other kinds of measurement you use on the job.

6: TOOL SKILLS

For your job do you use?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Hand Tools						
Tape Measure						
Protractor						
Calipers						
Scales on Equipment						
Jigs						
Gauges or Dials on Equipment						
Mobile Equipment						
Calculator						
Computer						
Advanced Instruments / Instrumentation						

Are you comfortable with the kinds of math your job requires Yes ☐ No ☐

III: JOB SITE COMMUNICATION SKILLS

1: WRITING SKILLS

On the job do you?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Fill in Forms						
Fill in Time Cards						
Keep Track of Hours						
Write Shift Reports						
Leave Notes / Memos						
Write Work Orders						
Write Incident Reports						
Write Instructions						
Make Drawing / Sketches						
Write Letters / Reports						
Write Safety Reports						
Shop Queries						
E-Mail						
Input Data on Computer						

2: ORAL SKILLS

On the job do you?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Follow Verbal Directions						
Give Verbal Directions						
Follow Written Directions						
Give Written Directions						
Ask Questions						
Take Messages						
Speak in Large Groups						
Speak in Small Groups						
Speak with Outside People [eg suppliers]						
Participate in Meetings						
Use the Telephone						

3: TOOL USE SKILLS

On the job do you?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Use the Typewriter						
Use the Fax Machine						
Use the Photocopier						
Use Hand Signals						
Use 2 Way Radio						
Use Mainframe Computer						
Use Process Control Computer						
Use a Personal Desktop Computer						
Use a Portable Computer						
Use a Modem						
Use Remote Control Radio Equipment						
Coordinate Work With Other Groups						
Work with Trade Groups						

4: SOCIAL SKILLS

On the job do you	No	Yes	Daily	Weekly	Monthly	1/2 Year
Work by yourself						
Work with a partner or helper						
Work as a member of a team						

5: Please list any other kinds of communications skills you use on the job.

6: PERSONAL COMMUNICATION SKILLS

Are you ?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Involved in community groups						
Involved in PTA						
Involved in church groups						
Involved in recreational groups						
Involved in children's groups						
Others						

SURVEY INTERVIEW FORM [cont.]

IV: **PRODUCTIVE THINKING SKILLS**

1: **INFORMATION PROCESSING SKILLS:**

On the job do you:	No	Yes	Daily	Weekly	Monthly	1/2 Year
Process information in a variety of ways						
Research information or data						
Analyze information or data						
Design systems						
Design products						
Engineer solutions						
Perform system analysis[trouble shooting]						
Perform technological assessments						
Identify inconsistencies, deficiencies, and contradictions						
Make inferences						
Identify main ideas						
Summarize and condense information, facts						
Note similarities and differences between facts						
Classify facts						
Identify stated and unstated reasons						
Recognize associations and connects information						
Form conclusions and generalizations from facts						
Make predictions on the basis of patterns in data						
Evaluate inf. according to set criteria						
Make Decisions based on Information Supplied by Others						

2: **JUDGMENT AND DECISION MAKING SKILLS:**

On the job are you required to	No	Yes	Daily	Weekly	Monthly	1/2 Year
Identify facts, opinions, and reasoned arguments						
Recognize evidence and check it						
Deal with differing value systems						
Distinguish between valid and questionable assumptions						
Spot inconsistencies and gaps in information						
Gather and organize data						
Decide whether statements contradict each other						
Evaluate others judgments						

3: **PROBLEM SOLVING SKILLS:**

On the job are you required to	No	Yes	Daily	Weekly	Monthly	1/2 Year
Solve problems on your own						
Solve problems as a member of a team						
Identify general problems						
Determine the attributes of a problem						
Clarify the problem for others						
Formulate questions about the problem						
Formulate hypotheses for testing						
Evaluate hypotheses						
Figure out experiments to test hypotheses						
integrate inf. about the problem						
Formulate solutions						
Examine and rank solutions						
Choose solutions as an individual						
Choose solutions as a member of a team						
Direct others in the application of the solution						
Seek acceptance of solutions						
Monitor solutions						

4: **FORMAL REASONING, CRITICAL THINKING, LOGIC SKILLS**

On the job do you	No	Yes	Daily	Weekly	Monthly	1/2 Year
Determine the meaning of terms and statements						
Notice qualities of things: how things differ or are alike						
Notice successive stages in which things occur						
Break down wholes into component parts						
Identify and sort things into classes						
Recognize analogies and reason by analogy						
Represent ideas as three-dimensional images						
Judge the credibility of sources						
Detect bias, stereotypes						
Distinguish relevant from irrelevant data						
Distinguish fact from opinion						
Connect causes and effects						
Use scientific method as a process of validation						
Use evidence to examine the validity of beliefs						
Examine arguments for ambiguity in the line of reasoning and for contradictory statements						
Judge whether a definition is adequate, an assumption is correct, and a conclusion is possible, valid or necessary						
Use syllogistic reasoning						
Analyze and evaluate arguments						

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SURVEY INTERVIEW FORM [cont.]

CREATIVE THINKING SKILLS

On the job do you?	No	Yes	Daily	Weekly	Monthly	1/2 Year
Analyzes open-ended situations and problems and restates, reorganizes, or breaks down the problem						
Lists attributes of objects and situations						
Generates ideas						
Generates multiple ideas to support multiple viewpoints on the same issue						
Identifies and examines alternatives						
Ranks alternatives and chooses the best						
Uses insight						
Uses intuition						
Identifies relationships between situations that may appear unconnected						
Makes unusual connections between facts						
Tolerate ambiguity, hold conclusion off to search for innovative ideas						
Elaborates details						
Synthesizes from various sources to form a new whole						
Extrapolates from limited facts						
Uses imagery						
Uses metacognition						
Uses metadata						

LEARNING PREFERENCES

If courses you were interested in were offered, when and how would you prefer to take them?

TIME

Mon.	Tues.	Wed.	Thurs.	Fri.
Morning	Afternoons	Evenings	Other	When

SCHEDULE

Once per week	
Twice per week	
Classroom	
Correspondence	
Computer assisted	

LOCATION

In a school	On job site	Union hall	Other

RANKED USE AND FREQUENCY OF USE TABLES

Reading Skills

Total Workforce			Hourly Workforce			Salaried Workforce		
Jobsite Materials	Use	Freq	Jobsite Materials	Use	Freq	Jobsite Materials	Use	Freq
Safety Signs / Posters	94.40%	72.88%	Drawings / Sketches	94.44%	95.59%	Safety Signs / Posters	100.00%	60.00%
Symbols	93.60%	95.73%	Symbols	91.67%	96.97%	Memos or Notes	100.00%	100.00%
Memos or Notes	93.60%	88.03%	Specifications	88.89%	95.31%	Computer Screen	100.00%	98.15%
Operating Instructions	90.40%	71.68%	Company Rules / Regulations	88.89%	17.19%	Computer Printouts	96.23%	98.04%
Company Rules / Regulations	90.40%	19.47%	Safety Signs / Posters	87.50%	84.13%	Symbols	96.23%	94.12%
Check Lists	88.00%	90.91%	Memos or Notes	87.50%	77.78%	Operating Instructions	96.23%	74.51%
Specifications	87.20%	92.66%	Check Lists	86.11%	93.55%	Charts, Tables or Graphs	94.34%	84.00%
Charts, Tables or Graphs	85.60%	84.11%	Operating Instructions	86.11%	69.35%	Company Rules / Regulations	92.45%	22.45%
Manuals	84.00%	70.48%	Hazard Labels / WHIMIS / MSDS	84.72%	63.93%	Check Lists	90.57%	87.50%
Drawings / Sketches	83.20%	92.31%	Safety Regulations	84.72%	29.51%	Manuals	90.57%	70.83%
Safety Regulations	82.40%	23.30%	Charts, Tables or Graphs	79.17%	84.21%	Specifications	84.91%	88.89%
Production / Work Schedules	77.60%	91.75%	Manuals	79.17%	70.18%	Production / Work Schedules	81.13%	83.72%
Hazard Labels / WHIMIS / MSDS	75.20%	53.19%	Production / Work Schedules	75.00%	98.15%	Time / Log Sheets	79.25%	90.48%
Computer Printouts	74.40%	95.70%	Tool or Equipment Instructions	72.22%	57.69%	Safety Regulations	79.25%	14.29%
Computer Screen	73.60%	92.39%	Time / Log Sheets	59.72%	90.70%	Technical Literature	77.36%	60.98%
Tool or Equipment Instructions	68.80%	46.51%	Computer Printouts	58.33%	92.86%	Drawings / Sketches	67.92%	86.11%
Time / Log Sheets	68.00%	98.59%	Shop Orders	56.94%	100.00%	Technical Journals	67.92%	72.22%
Technical Literature	57.60%	55.56%	Computer Screen	52.78%	84.21%	Tool or Equipment Instructions	64.15%	29.41%
Technical Journals	55.20%	53.62%	Technical Journals	45.83%	33.33%	Hazard Labels / WHIMIS / MSDS	62.26%	33.33%
Shop Orders	52.00%	93.85%	Technical Literature	43.06%	48.39%	Process Improvement Team Minutes	54.72%	51.72%
Mill Specs	35.20%	70.45%	Mill Specs	38.89%	78.57%	Shop Orders	45.28%	83.33%
DND Documents	33.60%	50.00%	Special Process Reports	29.17%	52.38%	Technical Reports	41.51%	81.82%
Technical Reports	32.80%	51.22%	DND Documents	29.17%	47.62%	Permits	41.51%	54.55%
Permits	32.00%	60.00%	Technical Reports	26.39%	15.79%	Contracts	39.62%	57.14%
Process Improvement Team Minutes	32.00%	55.00%	Permits	25.00%	66.67%	DND Documents	39.62%	52.38%
Special Process Reports	30.40%	50.00%	CFTO's	25.00%	55.56%	Commercial Specifications	37.74%	50.00%
Commercial Specifications	30.40%	44.74%	Commercial Specifications	25.00%	38.89%	Computer Memos	33.96%	83.33%
CFTO's	25.60%	62.50%	Schematics	20.83%	60.00%	Schematics	32.08%	58.82%
Schematics	25.60%	59.38%	International Documents	16.67%	58.33%	Special Process Reports	32.08%	47.06%
Computer Memos	21.60%	74.07%	Process Improvement Team Minutes	15.28%	63.64%	Mill Specs	30.19%	56.25%
Contracts	20.80%	57.69%	Computer Memos	12.50%	55.56%	CFTO's	26.42%	71.43%
International Documents	20.80%	53.85%	DOT Documents	12.50%	22.22%	International Documents	26.42%	50.00%
Micro Fich	14.40%	22.22%	Contracts	6.94%	60.00%	Micro Fich	24.53%	23.08%
DOT Documents	12.80%	37.50%	Micro Fich	6.94%	20.00%	DOT Documents	13.21%	57.14%
E-Mail	4.00%	80.00%	E-Mail	0.00%	0.00%	E-Mail	9.43%	80.00%

Total Workforce			Hourly Workforce			Salaried Workforce		
Company/Union Material	Use	Freq	Company/Union Material	Use	Freq	Company/Union Material	Use	Freq
Company Newsletter	80.00%	1.00%	Collective Agreement	86.11%	14.52%	Company Newsletter	75.47%	0.00%
Union Newsletter	68.80%	1.16%	Company Newsletter	83.33%	1.67%	Training Material	69.81%	29.73%
Collective Agreement	63.20%	18.99%	Union Newsletter	79.17%	1.75%	Monthly reports from Other Work Areas	67.92%	47.22%
Safety & Health Minutes	63.20%	12.66%	Safety & Health Minutes	77.78%	12.50%	Background Information Other Areas	54.72%	31.03%
Training Material	60.80%	23.68%	Pension Information	68.06%	2.04%	Union Newsletter	54.72%	0.00%
Pension Information	60.80%	5.26%	Benefits Statement	62.50%	4.44%	Pension Information	50.94%	11.11%
Benefits Statement	52.00%	6.15%	Training Material	54.17%	17.95%	Budgets / Costs	49.06%	57.69%
Workplace Safety & Health Act	39.20%	14.29%	Constitution & Bylaws [Union]	54.17%	10.26%	Safety & Health Minutes	43.40%	13.04%
Monthly reports from Other Work Areas	38.40%	43.75%	Workplace Safety & Health Act	50.00%	13.89%	Benefits Statement	37.74%	10.00%
Constitution & Bylaws [Union]	35.20%	11.36%	Annual Report	20.83%	20.00%	Collective Agreement	32.08%	35.29%
Background Information Other Areas	32.00%	27.50%	Monthly reports from Other Work Areas	16.67%	33.33%	Workplace Safety & Health Act	24.53%	15.38%
Budgets / Costs	30.40%	47.37%	Budgets / Costs	16.67%	25.00%	Annual Report	22.64%	8.33%
Annual Report	21.60%	14.81%	Background Information Other Areas	15.28%	18.18%	Shareholders Report	18.87%	0.00%
Shareholders Report	16.00%	5.00%	Shareholders Report	13.89%	10.00%	Constitution & Bylaws [Union]	9.43%	20.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Reading Skills [cont.]

Skilled Manual			Skilled Craftsperson			Supervisor		
Jobsite Materials	Use	Freq	Jobsite Materials	Use	Freq	Jobsite Materials	Use	Freq
Safety Signs / Posters	92.31%	86.11%	Drawings / Sketches	100.00%	96.97%	Computer Screen	100.00%	100.00%
Symbols	89.74%	97.14%	Check Lists	93.94%	96.77%	Computer Printouts	100.00%	100.00%
Production / Work Schedules	87.18%	100.00%	Symbols	93.94%	96.77%	Memos or Notes	100.00%	100.00%
Specifications	87.18%	97.06%	Specifications	90.91%	93.33%	Operating Instructions	100.00%	100.00%
Safety Regulations	87.18%	32.35%	Memos or Notes	90.91%	76.67%	Charts, Tables or Graphs	100.00%	75.00%
Company Rules / Regulations	87.18%	17.65%	Hazard Labels / WHMIS / MSDS	90.91%	56.67%	Manuals	100.00%	75.00%
Drawings / Sketches	84.62%	93.94%	Company Rules / Regulations	90.91%	16.67%	Symbols	100.00%	75.00%
Memos or Notes	84.62%	78.79%	Operating Instructions	87.88%	62.07%	Company Rules / Regulations	100.00%	50.00%
Operating Instructions	84.62%	75.76%	Manuals	84.85%	75.00%	Safety Signs / Posters	100.00%	50.00%
Check Lists	79.49%	90.32%	Charts, Tables or Graphs	81.82%	88.89%	Drawings / Sketches	75.00%	100.00%
Hazard Labels / WHMIS / MSDS	79.49%	78.97%	Safety Signs / Posters	81.82%	81.48%	Specifications	75.00%	100.00%
Charts, Tables or Graphs	76.92%	80.00%	Safety Regulations	81.82%	25.93%	Time / Log Sheets	75.00%	100.00%
Manuals	74.36%	65.52%	Tool or Equipment Instructions	72.73%	54.17%	Tool or Equipment Instructions	75.00%	33.33%
Tool or Equipment Instructions	71.79%	60.71%	Computer Screen	69.70%	86.96%	Hazard Labels / WHMIS / MSDS	75.00%	33.33%
Time / Log Sheets	61.54%	100.00%	Technical Journals	63.64%	28.57%	Technical Journals	75.00%	33.33%
Shop Orders	61.54%	100.00%	Production / Work Schedules	60.61%	95.00%	Technical Literature	75.00%	33.33%
Computer Printouts	61.54%	95.83%	Time / Log Sheets	57.58%	78.95%	Process Improvement Team Minutes	75.00%	33.33%
Computer Screen	38.46%	80.00%	Computer Printouts	54.55%	88.89%	Safety Regulations	75.00%	0.00%
Mill Specs	38.46%	80.00%	Technical Literature	54.55%	50.00%	Production / Work Schedules	50.00%	100.00%
Technical Literature	33.33%	46.15%	Shop Orders	51.52%	100.00%	Check Lists	50.00%	100.00%
Special Process Reports	30.77%	50.00%	Mill Specs	39.39%	76.92%	Shop Orders	50.00%	100.00%
Technical Journals	30.77%	41.67%	DND Documents	39.39%	38.46%	CFTO's	50.00%	100.00%
Technical Reports	25.64%	20.00%	Permits	30.30%	70.00%	Technical Reports	50.00%	100.00%
Permits	20.51%	62.50%	Schematics	30.30%	70.00%	Mill Specs	50.00%	50.00%
DND Documents	20.51%	62.50%	CFTO's	30.30%	60.00%	Special Process Reports	50.00%	50.00%
CFTO's	20.51%	50.00%	Commercial Specifications	30.30%	50.00%	DND Documents	50.00%	50.00%
Commercial Specifications	20.51%	25.00%	Special Process Reports	27.27%	55.56%	Schematics	25.00%	100.00%
Process Improvement Team Minutes	15.38%	66.67%	Technical Reports	27.27%	11.11%	Commercial Specifications	25.00%	100.00%
International Documents	12.82%	80.00%	International Documents	21.21%	42.86%	Computer Memos	25.00%	100.00%
Schematics	12.82%	40.00%	DOT Documents	21.21%	14.29%	Contracts	25.00%	0.00%
Computer Memos	10.26%	50.00%	Computer Memos	15.15%	60.00%	International Documents	25.00%	0.00%
Contracts	7.69%	66.67%	Process Improvement Team Minutes	15.15%	60.00%	Micro Fich	25.00%	0.00%
DOT Documents	5.13%	50.00%	Micro Fich	9.09%	33.33%	Permits	0.00%	0.00%
Micro Fich	5.13%	0.00%	Contracts	6.06%	50.00%	DOT Documents	0.00%	0.00%
E-Mail	0.00%	0.00%	E-Mail	0.00%	0.00%	E-Mail	0.00%	0.00%

Skilled Manual			Skilled Craftsperson			Supervisor		
Company/Union Material	Use	Freq	Company/Union Material	Use	Freq	Company/Union Material	Use	Freq
Collective Agreement	87.18%	17.65%	Company Newsletter	90.91%	0.00%	Company Newsletter	100.00%	0.00%
Safety & Health Minutes	76.92%	13.33%	Collective Agreement	84.85%	10.71%	Collective Agreement	75.00%	66.67%
Company Newsletter	76.92%	3.33%	Union Newsletter	84.85%	0.00%	Budgets / Costs	75.00%	33.33%
Pension Information	74.36%	3.45%	Safety & Health Minutes	78.79%	11.54%	Safety & Health Minutes	75.00%	0.00%
Union Newsletter	74.36%	3.45%	Constitution & Bylaws [Union]	66.67%	4.55%	Pension Information	75.00%	0.00%
Benefits Statement	71.79%	7.14%	Pension Information	60.61%	0.00%	Training Material	75.00%	0.00%
Training Material	53.85%	14.29%	Workplace Safety & Health Act	57.58%	5.26%	Monthly reports from Other Work Areas	75.00%	0.00%
Workplace Safety & Health Act	43.59%	23.53%	Training Material	54.55%	22.22%	Workplace Safety & Health Act	50.00%	0.00%
Constitution & Bylaws [Union]	43.59%	17.65%	Benefits Statement	51.52%	0.00%	Benefits Statement	50.00%	0.00%
Annual Report	23.08%	11.11%	Budgets / Costs	24.24%	12.50%	Background Information Other Areas	50.00%	0.00%
Shareholders Report	15.38%	16.67%	Monthly reports from Other Work Areas	21.21%	28.57%	Annual Report	50.00%	0.00%
Monthly reports from Other Work Areas	12.82%	40.00%	Annual Report	18.18%	33.33%	Shareholders Report	25.00%	0.00%
Background Information Other Areas	12.82%	20.00%	Background Information Other Areas	18.18%	16.67%	Union Newsletter	25.00%	0.00%
Budgets / Costs	10.26%	50.00%	Shareholders Report	12.12%	0.00%	Constitution & Bylaws [Union]	0.00%	0.00%

RANKED USE AND FREQUENCY OF USE TABLES

Reading Skills [cont.]

Clerical/Sales			Technical			Professional		
Jobsite Materials	Use	Freq	Jobsite Materials	Use	Freq	Jobsite Materials	Use	Freq
Computer Screen	90.91%	100.00%	Computer Screen	100.00%	100.00%	Time / Log Sheets	100.00%	83.33%
Memos or Notes	90.91%	100.00%	Memos or Notes	100.00%	93.24%	Specifications	100.00%	100.00%
Charts, Tables or Graphs	90.91%	70.00%	Computer Printouts	100.00%	95.00%	Computer Screen	100.00%	100.00%
Symbols	81.82%	88.89%	Symbols	100.00%	95.00%	Computer Printouts	100.00%	100.00%
Operating Instructions	81.82%	33.33%	Check Lists	100.00%	90.00%	Charts, Tables or Graphs	100.00%	100.00%
Computer Printouts	72.73%	100.00%	Operating Instructions	100.00%	84.21%	Memos or Notes	100.00%	100.00%
Manuals	72.73%	25.00%	Specifications	94.74%	88.89%	Operating Instructions	100.00%	81.82%
Company Rules / Regulations	72.73%	0.00%	Company Rules / Regulations	94.74%	22.22%	Check Lists	100.00%	72.73%
Production / Work Schedules	63.64%	100.00%	Manuals	89.47%	94.12%	Manuals	100.00%	72.73%
Check Lists	63.64%	85.71%	Charts, Tables or Graphs	89.47%	76.47%	Safety Signs / Posters	100.00%	72.73%
Specifications	54.55%	66.67%	Safety Signs / Posters	89.47%	70.59%	Company Rules / Regulations	100.00%	18.18%
Hazard Labels / WHIMIS / MSDS	54.55%	16.67%	Technical Literature	89.47%	64.71%	Symbols	90.91%	100.00%
Safety Regulations	54.55%	0.00%	Drawings / Sketches	84.21%	93.75%	Production / Work Schedules	90.91%	60.00%
Safety Signs / Posters	45.45%	80.00%	Production / Work Schedules	84.21%	93.75%	Technical Literature	90.91%	50.00%
Time / Log Sheets	36.36%	100.00%	Safety Regulations	84.21%	18.75%	Technical Journals	81.82%	88.89%
Permits	36.36%	50.00%	Time / Log Sheets	78.95%	93.33%	Safety Regulations	81.82%	22.22%
Shop Orders	27.27%	100.00%	Technical Journals	73.68%	64.29%	Drawings / Sketches	72.73%	87.50%
Technical Journals	27.27%	100.00%	Tool or Equipment Instructions	57.89%	36.36%	Hazard Labels / WHIMIS / MSDS	72.73%	37.50%
Technical Literature	27.27%	100.00%	Hazard Labels / WHIMIS / MSDS	57.89%	36.36%	Tool or Equipment Instructions	72.73%	25.00%
Process Improvement Team Minutes	27.27%	66.67%	Process Improvement Team Minutes	52.63%	60.00%	Technical Reports	54.55%	66.67%
Contracts	18.18%	100.00%	Permits	52.63%	50.00%	Shop Orders	54.55%	50.00%
Computer Memos	18.18%	100.00%	Shop Orders	42.11%	100.00%	Contracts	54.55%	50.00%
Drawings / Sketches	18.18%	50.00%	DND Documents	42.11%	62.50%	Process Improvement Team Minutes	54.55%	33.33%
Tool or Equipment Instructions	18.18%	50.00%	Contracts	42.11%	37.50%	DND Documents	45.45%	80.00%
Commercial Specifications	9.09%	100.00%	Commercial Specifications	42.11%	37.50%	CFTO's	45.45%	80.00%
DOT Documents	9.09%	100.00%	Technical Reports	36.84%	100.00%	Mill Specs	45.45%	60.00%
DND Documents	9.09%	0.00%	Computer Memos	36.84%	71.43%	Commercial Specifications	45.45%	60.00%
E-Mail	9.09%	0.00%	Schematics	31.58%	100.00%	Special Process Reports	45.45%	40.00%
Mill Specs	0.00%	0.00%	International Documents	31.58%	50.00%	Schematics	45.45%	40.00%
Special Process Reports	0.00%	0.00%	Mill Specs	26.32%	60.00%	Permits	36.36%	75.00%
Schematics	0.00%	0.00%	CFTO's	26.32%	60.00%	Computer Memos	36.36%	75.00%
International Documents	0.00%	0.00%	Special Process Reports	26.32%	40.00%	E-Mail	27.27%	100.00%
CFTO's	0.00%	0.00%	Micro Fich	26.32%	40.00%	International Documents	27.27%	66.67%
Micro Fich	0.00%	0.00%	DOT Documents	15.79%	33.33%	Micro Fich	27.27%	33.33%
Technical Reports	0.00%	0.00%	E-Mail	0.00%	0.00%	DOT Documents	18.18%	100.00%

Clerical/Sales			Technical			Professional		
Company/Union Material	Use	Freq	Company/Union Material	Use	Freq	Company/Union Material	Use	Freq
Training Material	90.91%	10.00%	Training Material	68.42%	53.85%	Company Newsletter	100.00%	0.00%
Company Newsletter	81.82%	0.00%	Monthly reports from Other Work Areas	63.16%	50.00%	Budgets / Costs	72.73%	62.50%
Pension Information	63.64%	14.29%	Company Newsletter	63.16%	0.00%	Monthly reports from Other Work Areas	72.73%	50.00%
Monthly reports from Other Work Areas	54.55%	50.00%	Union Newsletter	47.37%	0.00%	Benefits Statement	72.73%	0.00%
Benefits Statement	54.55%	0.00%	Safety & Health Minutes	42.11%	12.50%	Background Information Other Areas	63.64%	14.29%
Collective Agreement	45.45%	20.00%	Budgets / Costs	36.84%	57.14%	Pension Information	63.64%	0.00%
Safety & Health Minutes	36.36%	50.00%	Background Information Other Areas	36.84%	28.57%	Union Newsletter	63.64%	0.00%
Background Information Other Areas	36.36%	25.00%	Pension Information	15.79%	33.33%	Training Material	45.45%	20.00%
Workplace Safety & Health Act	36.36%	0.00%	Workplace Safety & Health Act	15.79%	33.33%	Safety & Health Minutes	36.36%	0.00%
Union Newsletter	36.36%	0.00%	Collective Agreement	5.26%	100.00%	Annual Report	36.36%	0.00%
Annual Report	27.27%	0.00%	Constitution & Bylaws [Union]	5.26%	100.00%	Collective Agreement	27.27%	0.00%
Shareholders Report	18.18%	0.00%	Benefits Statement	5.26%	100.00%	Workplace Safety & Health Act	18.18%	0.00%
Constitution & Bylaws [Union]	9.09%	0.00%	Annual Report	5.26%	100.00%	Shareholders Report	18.18%	0.00%
Budgets / Costs	9.09%	0.00%	Shareholders Report	0.00%	0.00%	Constitution & Bylaws [Union]	0.00%	0.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Reading Skills [cont.]

Management		
Jobsite Materials	Use	Freq
Memos or Notes	100.00%	100.00%
Computer Screen	100.00%	100.00%
Computer Printouts	100.00%	100.00%
Charts, Tables or Graphs	100.00%	100.00%
Check Lists	100.00%	100.00%
Symbols	100.00%	100.00%
Time / Log Sheets	100.00%	87.50%
Safety Signs / Posters	100.00%	87.50%
Production / Work Schedules	100.00%	75.00%
Operating Instructions	100.00%	75.00%
Manuals	100.00%	62.50%
Technical Literature	100.00%	62.50%
Company Rules / Regulations	100.00%	37.50%
Safety Regulations	100.00%	12.50%
Specifications	87.50%	85.71%
Technical Reports	87.50%	71.43%
Drawings / Sketches	87.50%	71.43%
Technical Journals	87.50%	71.43%
Process Improvement Team Minutes	87.50%	57.14%
Shop Orders	62.50%	80.00%
Special Process Reports	62.50%	60.00%
Hazard Labels / WHMIS / MSDS	62.50%	40.00%
Commercial Specifications	62.50%	40.00%
Schematics	62.50%	20.00%
DND Documents	62.50%	20.00%
Contracts	50.00%	100.00%
Computer Manuals	50.00%	100.00%
Permits	50.00%	50.00%
Mil Specs	50.00%	50.00%
International Documents	50.00%	50.00%
Micro Fich	50.00%	0.00%
CFTO's	25.00%	50.00%
E-Mail	12.50%	100.00%
DOT Documents	12.50%	0.00%

Management		
Company/Union Materials	Use	Freq
Background Information Other Areas	112.50%	55.56%
Union Newsletter	100.00%	0.00%
Budgets / Costs	87.50%	71.43%
Monthly reports from Other Work Areas	87.50%	57.14%
Pension Information	87.50%	14.29%
Training Material	75.00%	33.33%
Collective Agreement	62.50%	40.00%
Shareholders Report	62.50%	0.00%
Safety & Health Minutes	50.00%	0.00%
Company Newsletter	50.00%	0.00%
Benefits Statement	37.50%	33.33%
Constitution & Bylaws (Union)	37.50%	0.00%
Workplace Safety & Health Act	25.00%	50.00%
Annual Report	25.00%	0.00%

RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills

Total Workforce			Hourly Workforce			Salaried Workforce		
Basic Math	Use	Freq	Basic Math	Use	Freq	Basic Math	Use	Freq
Count How Many	96.00%	98.33%	Count How Many	97.22%	97.14%	Count How Many	94.34%	100.00%
Add or Subtract Numbers	90.40%	93.81%	Add or Subtract Numbers	88.89%	92.19%	Add or Subtract Numbers	92.45%	95.92%
Add or Subtract Decimals	84.80%	89.62%	Add or Subtract Decimals	84.72%	86.89%	Estimate Time	92.45%	93.88%
Estimate Time	83.20%	97.12%	Multiply or Divide Decimals	81.94%	86.44%	Add or Subtract Decimals	84.91%	93.33%
Multiply or Divide Numbers	81.60%	91.18%	Multiply or Divide Numbers	80.56%	87.93%	Multiply or Divide Numbers	83.02%	95.45%
Multiply or Divide Decimals	81.60%	90.20%	Estimate Time	76.39%	100.00%	Multiply or Divide Decimals	81.13%	95.35%
Estimate Materials	72.00%	93.33%	Convert Fractions & Decimals	73.61%	71.70%	Estimate Materials	81.13%	86.05%
Convert Fractions & Decimals	72.00%	74.44%	Estimate Materials	65.28%	100.00%	Convert Fractions & Decimals	69.81%	78.38%
Multiply or Divide Fractions	57.60%	83.33%	Add or Subtract Fractions	54.17%	76.92%	Multiply or Divide Fractions	64.15%	91.18%
Add or Subtract Fractions	56.80%	80.28%	Multiply or Divide Fractions	52.78%	76.32%	Add or Subtract Fractions	60.38%	84.38%

Total Workforce			Hourly Workforce			Salaried Workforce		
Technical Math	Use	Freq	Technical Math	Use	Freq	Technical Math	Use	Freq
Graphs, Charts, Tables	78.40%	88.70%	Graphs, Charts, Tables	73.61%	92.45%	Data	84.91%	95.56%
Data	74.40%	94.62%	Lines and Angles	69.44%	88.00%	Percentage [%]	84.91%	86.67%
Lines and Angles	68.00%	81.18%	3 Dimensional Shapes	69.44%	86.00%	Graphs, Charts, Tables	84.91%	84.44%
Problem Solving	66.40%	83.13%	Data	66.67%	93.75%	Negative Numbers	79.25%	83.33%
3 Dimensional Shapes	65.60%	76.83%	2 Dimensional Shapes	66.67%	93.75%	Problem Solving	77.36%	85.37%
2 Dimensional Shapes	64.00%	88.75%	Scale Drawings	65.28%	91.49%	Ratios or Proportions	69.81%	86.49%
Scale Drawings	63.20%	82.28%	Numerical Specifications	61.11%	97.73%	Estimating Solutions	69.81%	78.38%
Numerical Specifications	61.60%	96.10%	Problem Solving	58.33%	80.95%	Statistics	66.04%	71.43%
Ratios or Proportions	59.20%	82.43%	Ratios or Proportions	51.39%	78.38%	Lines and Angles	66.04%	71.43%
Estimating Solutions	58.40%	79.45%	Estimating Solutions	50.00%	80.56%	Probabilities	64.15%	61.76%
Right Triangle Relationships	49.60%	56.45%	Right Triangle Relationships	48.61%	54.29%	Numerical Specifications	62.26%	93.94%
Negative Numbers	48.00%	83.33%	Percentage [%]	45.83%	66.67%	2 Dimensional Shapes	60.38%	81.25%
Statistics	44.80%	66.07%	Trigonometric Functions	38.89%	57.14%	Scale Drawings	60.38%	68.75%
Trigonometric Functions	41.60%	61.54%	Bend Allowances	34.72%	68.00%	3 Dimensional Shapes	60.38%	62.50%
Probabilities	40.00%	60.00%	Use Concentration Data [p.p.m., g.p.l., etc.]	34.72%	68.00%	Right Triangle Relationships	50.94%	59.26%
Use Concentration Data [p.p.m., g.p.l., etc.]	37.60%	65.96%	Formulas	30.56%	72.73%	Trigonometric Functions	45.28%	66.67%
Uses of Powers and Roots	35.20%	54.55%	Chemical Proportions	29.17%	76.19%	Uses of Powers and Roots	43.40%	69.57%
Formulas	31.20%	76.92%	Statistics	29.17%	57.14%	Use Concentration Data [p.p.m., g.p.l., etc.]	41.51%	63.64%
Bend Allowances	29.60%	67.57%	Uses of Powers and Roots	29.17%	38.10%	Scientific Notations	37.74%	65.00%
Signed Numbers and Vectors	28.80%	50.00%	Negative Numbers	25.00%	83.33%	Applied Linear Equations	37.74%	55.00%
Scientific Notations	25.60%	56.25%	Signed Numbers and Vectors	23.61%	52.94%	Signed Numbers and Vectors	35.85%	47.37%
Chemical Proportions	24.00%	73.33%	Probabilities	22.22%	56.25%	Formulas	32.08%	82.35%
Applied Linear Equations	23.20%	51.72%	Scientific Notations	16.67%	41.67%	Applied Non Linear Equations	26.42%	28.57%
Applied Non Linear Equations	18.40%	39.13%	Applied Non Linear Equations	12.50%	55.56%	Bend Allowances	22.64%	66.67%
Percentage [%]	15.20%	321.05%	Applied Linear Equations	12.50%	44.44%	Chemical Proportions	16.98%	66.67%
Convert Hex to Decimal	9.60%	58.33%	Convert Hex to Decimal	5.56%	100.00%	Convert Hex to Decimal	15.09%	37.50%

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RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills [cont.]

Total Workforce			Hourly Workforce			Salaried Workforce		
Measurement Skills	Use	Freq	Measurement Skills	Use	Freq	Measurement Skills	Use	Freq
Measure in Imperial	82.40%	97.09%	Precision, Accuracy, Tolerance	95.83%	97.10%	Measure in Imperial	75.47%	95.00%
Precision, Accuracy, Tolerance	81.60%	97.06%	Measure in Imperial	87.50%	98.41%	Measure in Metric	71.70%	81.58%
Measure in Metric	64.80%	72.84%	Circumference	62.50%	77.78%	Precision, Accuracy, Tolerance	62.26%	96.97%
Circumference	56.00%	81.43%	Measure in Metric	59.72%	65.12%	Convert Imperial & Metric Measures	62.26%	78.79%
Radius	53.60%	83.58%	Radius	58.33%	80.95%	Volume	60.38%	68.75%
Convert Imperial & Metric Measures	53.60%	68.66%	Pressure	56.94%	73.17%	Radius	47.17%	88.00%
Volume	52.80%	66.67%	Temperature	54.17%	76.92%	Circumference	47.17%	88.00%
Temperature	51.20%	75.00%	Mass\Weight	47.22%	79.41%	Temperature	47.17%	72.00%
Pressure	49.60%	70.97%	Acceleration	47.22%	70.59%	Flow	45.28%	62.50%
Mass\Weight	45.60%	73.68%	Volume	47.22%	64.71%	Density	45.28%	62.50%
Acceleration	45.60%	66.67%	Convert Imperial & Metric Measures	47.22%	58.82%	Mass\Weight	43.40%	65.22%
Flow	44.80%	71.43%	Time	44.44%	93.75%	Acceleration	43.40%	60.87%
Time	42.40%	92.45%	Flow	44.44%	78.13%	Time	39.62%	90.48%
Density	42.40%	71.70%	Density	40.28%	79.31%	Pressure	39.62%	66.67%
Measure Current / Voltage	34.40%	53.49%	Measure Current / Voltage	30.56%	72.73%	Measure Current / Voltage	39.62%	33.33%
Millivolts/ Milliamps	27.20%	55.88%	Stress	22.22%	81.25%	Millivolts/ Milliamps	33.96%	38.89%
Productivity	23.20%	82.76%	Millivolts/ Milliamps	22.22%	75.00%	Productivity	32.08%	82.35%
Stress	20.80%	80.77%	Tension	19.44%	78.57%	Conductivity	20.75%	27.27%
Tension	18.40%	82.61%	Productivity	16.67%	83.33%	Stress	18.87%	80.00%
Conductivity	17.60%	59.09%	Conductivity	15.28%	90.91%	Tension	16.98%	88.89%
Resistance	13.60%	52.94%	Resistance	11.11%	87.50%	Capacitance	16.98%	33.33%
Capacitance	10.40%	53.85%	pH	11.11%	50.00%	Resistance	16.98%	22.22%
pH	10.40%	38.46%	Fed in lb.	6.94%	60.00%	Optical units	15.09%	12.50%
Fed in lb.	9.60%	33.33%	Capacitance	5.56%	100.00%	Fed in lb.	13.21%	14.29%
Optical units	9.60%	25.00%	Optical units	5.56%	50.00%	pH	9.43%	20.00%

Total Workforce			Hourly Workforce			Salaried Workforce		
Tool Use Skills	Use	Freq	Tool Use Skills	Use	Freq	Tool Use Skills	Use	Freq
Tape Measure	96.00%	92.50%	Tape Measure	101.39%	97.26%	Hand Tools	96.23%	98.04%
Hand Tools	95.20%	99.16%	Hand Tools	94.44%	100.00%	Computer	90.57%	100.00%
Calculator	76.80%	90.63%	Gauges or Dials on Equipment	81.94%	93.22%	Tape Measure	88.68%	85.11%
Gauges or Dials on Equipment	73.60%	88.04%	Scales on Equipment	81.94%	91.53%	Calculator	84.91%	[illegible]
Scales on Equipment	73.60%	86.96%	Calculator	70.83%	86.27%	Scales on Equipment	62.26%	[illegible]
Computer	68.00%	95.29%	Calipers	68.06%	95.92%	Gauges or Dials on Equipment	62.26%	[illegible]
Calipers	58.40%	83.56%	Protractor	66.67%	77.08%	Advanced Instruments / Instrumentation	45.28%	[illegible]
Protractor	56.00%	67.14%	Jigs	59.72%	90.70%	Calipers	45.28%	58.33%
Advanced Instruments / Instrumentation	52.80%	90.91%	Advanced Instruments / Instrumentation	58.33%	97.62%	Protractor	41.51%	45.45%
Jigs	40.80%	98.20%	Computer	51.39%	89.19%	Mobile Equipment	16.98%	33.33%
Mobile Equipment	29.60%	72.97%	Mobile Equipment	38.89%	85.71%	Jigs	15.09%	[illegible]

RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills [cont.]

Skilled Manual			Skilled Craftsperson			Supervisor		
Basic Math	**Use**	**Freq**	**Basic Math**	**Use**	**Freq**	**Basic Math**	**Use**	**Freq**
Count How Many	94.87%	97.30%	Count How Many	100.00%	96.97%	Add or Subtract Numbers	100.00%	100.00%
Add or Subtract Numbers	82.05%	90.63%	Add or Subtract Numbers	96.97%	93.75%	Count How Many	100.00%	100.00%
Multiply or Divide Decimals	79.49%	87.10%	Add or Subtract Decimals	90.91%	93.33%	Estimate Time	100.00%	100.00%
Add or Subtract Decimals	79.49%	80.65%	Multiply or Divide Numbers	84.85%	92.86%	Add or Subtract Fractions	100.00%	75.00%
Multiply or Divide Numbers	76.92%	83.33%	Multiply or Divide Decimals	84.85%	85.71%	Add or Subtract Decimals	100.00%	75.00%
Estimate Time	74.36%	100.00%	Convert Fractions & Decimals	84.85%	67.86%	Convert Fractions & Decimals	100.00%	75.00%
Convert Fractions & Decimals	64.10%	76.00%	Estimate Time	78.79%	100.00%	Multiply or Divide Numbers	75.00%	100.00%
Estimate Materials	53.85%	100.00%	Estimate Materials	78.79%	100.00%	Multiply or Divide Fractions	75.00%	100.00%
Add or Subtract Fractions	51.28%	80.00%	Multiply or Divide Fractions	57.58%	78.95%	Multiply or Divide Decimals	75.00%	100.00%
Multiply or Divide Fractions	48.72%	73.68%	Add or Subtract Fractions	57.58%	73.68%	Estimate Materials	75.00%	100.00%

Skilled Manual			Skilled Craftsperson			Supervisor		
Technical Math	**Use**	**Freq**	**Technical Math**	**Use**	**Freq**	**Technical Math**	**Use**	**Freq**
Graphs, Charts, Tables	66.67%	92.31%	Data	84.85%	100.00%	Data	100.00%	75.00%
Lines and Angles	58.97%	95.65%	3 Dimensional Shapes	84.85%	85.71%	Graphs, Charts, Tables	100.00%	50.00%
2 Dimensional Shapes	58.97%	95.65%	Graphs, Charts, Tables	81.82%	92.59%	Percentage [%]	75.00%	100.00%
Scale Drawings	56.41%	95.45%	Lines and Angles	81.82%	81.48%	Negative Numbers	75.00%	100.00%
3 Dimensional Shapes	56.41%	86.36%	Numerical Specifications	75.76%	100.00%	Numerical Specifications	75.00%	100.00%
Problem Solving	53.85%	66.67%	2 Dimensional Shapes	75.76%	92.00%	Statistics	75.00%	66.67%
Data	51.28%	85.00%	Scale Drawings	75.76%	88.00%	Probabilities	75.00%	66.67%
Numerical Specifications	48.72%	94.74%	Problem Solving	63.64%	95.24%	Scale Drawings	75.00%	66.67%
Estimating Solutions	46.15%	72.22%	Ratios or Proportions	60.61%	80.00%	Lines and Angles	75.00%	66.67%
Right Triangle Relationships	46.15%	44.44%	Trigonometric Functions	57.58%	73.68%	Use Concentration Data [p.p.m., g.p.l., etc.]	75.00%	66.67%
Ratios or Proportions	43.59%	76.47%	Estimating Solutions	54.55%	88.89%	Ratios or Proportions	50.00%	100.00%
Use Concentration Data [p.p.m., g.p.l., etc.]	43.59%	76.47%	Percentage [%]	54.55%	77.78%	2 Dimensional Shapes	50.00%	100.00%
Chemical Proportions	38.46%	80.00%	Right Triangle Relationships	51.52%	64.71%	Problem Solving	50.00%	100.00%
Percentage [%]	38.46%	53.33%	Bend Allowances	39.39%	76.92%	Chemical Proportions	50.00%	100.00%
Formulas	33.33%	69.23%	Statistics	39.39%	69.23%	3 Dimensional Shapes	50.00%	50.00%
Bend Allowances	30.77%	58.33%	Uses of Powers and Roots	39.39%	38.46%	Estimating Solutions	50.00%	50.00%
Trigonometric Functions	23.08%	22.22%	Signed Numbers and Vectors	36.36%	58.33%	Right Triangle Relationships	50.00%	0.00%
Negative Numbers	20.51%	87.50%	Negative Numbers	30.30%	80.00%	Bend Allowances	25.00%	100.00%
Probabilities	20.51%	62.50%	Formulas	27.27%	77.78%	Trigonometric Functions	25.00%	100.00%
Statistics	20.51%	37.50%	Scientific Notations	27.27%	44.44%	Applied Linear Equations	25.00%	100.00%
Uses of Powers and Roots	20.51%	37.50%	Probabilities	24.24%	50.00%	Applied Non Linear Equations	25.00%	100.00%
Signed Numbers and Vectors	12.82%	40.00%	Use Concentration Data [p.p.m., g.p.l., etc.]	24.24%	50.00%	Formulas	25.00%	100.00%
Applied Non Linear Equations	10.26%	50.00%	Chemical Proportions	18.18%	66.67%	Uses of Powers and Roots	25.00%	0.00%
Applied Linear Equations	7.69%	33.33%	Applied Linear Equations	18.18%	50.00%	Signed Numbers and Vectors	25.00%	0.00%
Scientific Notations	7.69%	33.33%	Applied Non Linear Equations	15.15%	60.00%	Convert Hex to Decimal	25.00%	0.00%
Convert Hex to Decimal	5.13%	100.00%	Convert Hex to Decimal	6.06%	100.00%			

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RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills [cont.]

Skilled Manual			Skilled Craftsperson			Supervisor		
Measurement Skills	Use	Freq	Measurement Skills	Use	Freq	Measurement Skills	Use	Freq
Precision, Accuracy, Tolerance	92.31%	97.22%	Measure in Imperial	100.00%	96.97%	Do you work with?	Use	Freq
Measure in Imperial	84.62%	96.97%	Measure in Metric	90.91%	100.00%	Measure in Imperial	75.00%	100.00%
Radius	61.54%	87.50%	Convert Imperial & Metric Measures	66.67%	81.82%	Measure in Metric	75.00%	100.00%
Measure in Metric	61.54%	79.17%	Volume	66.67%	77.27%	Convert Imperial & Metric Measures	75.00%	100.00%
Circumference	61.54%	79.17%	Precision, Accuracy, Tolerance	63.64%	76.19%	Volume	75.00%	100.00%
Volume	48.72%	78.95%	Radius	57.58%	63.16%	Precision, Accuracy, Tolerance	75.00%	100.00%
Mass\Weight	48.72%	73.68%	Circumference	57.58%	52.63%	Temperature	75.00%	100.00%
Pressure	48.72%	68.42%	Temperature	57.58%	47.37%	Measure Current / Voltage	75.00%	66.67%
Time	43.59%	94.12%	Pressure	54.55%	72.22%	Radius	75.00%	33.33%
Temperature	43.59%	70.59%	Flow	54.55%	72.22%	Circumference	75.00%	33.33%
Acceleration	38.46%	80.00%	Mass\Weight	45.45%	93.33%	Density	75.00%	33.33%
Convert Imperial & Metric Measures	38.46%	66.67%	Acceleration	45.45%	86.67%	Pressure	50.00%	100.00%
Flow	35.90%	85.71%	Density	45.45%	73.33%	Mass\Weight	50.00%	100.00%
Density	35.90%	85.71%	Time	45.45%	46.67%	Millivolts/ Milliamps	50.00%	100.00%
Stress	28.21%	81.82%	Stress	42.42%	64.29%	Flow	50.00%	50.00%
Productivity	23.08%	88.89%	Tension	30.30%	70.00%	Acceleration	50.00%	50.00%
Tension	23.08%	77.78%	Optical units	21.21%	85.71%	Stress	50.00%	50.00%
Measure Current / Voltage	20.51%	87.50%	pH	15.15%	80.00%	Time	25.00%	100.00%
Millivolts/ Milliamps	15.38%	83.33%	Feel in lb.	15.15%	80.00%	Tension	25.00%	100.00%
Conductivity	10.26%	100.00%	Capacitance	15.15%	80.00%	Feel in lb.	25.00%	100.00%
pH	10.26%	75.00%	Resistance	12.12%	25.00%	Capacitance	25.00%	100.00%
Resistance	7.69%	100.00%	Conductivity	9.09%	100.00%	Resistance	25.00%	100.00%
Feel in lb.	7.69%	33.33%	Measure Current / Voltage	9.09%	66.67%	Conductivity	25.00%	100.00%
Optical units	5.13%	50.00%	Millivolts/ Milliamps	6.06%	100.00%	Productivity	25.00%	100.00%
Capacitance	2.56%	100.00%	Productivity	6.06%	50.00%			

Skilled Manual			Skilled Craftsperson			Supervisor		
Tool Skills	Use	Freq	Tool Skills	Use	Freq	Tool Skills	Use	Freq
Tape Measure	97.44%	97.37%	Tape Measure	100.00%	96.97%	Hand Tools	100.00%	100.00%
Hand Tools	94.87%	100.00%	Hand Tools	93.94%	100.00%	Calculator	100.00%	100.00%
Scales on Equipment	84.62%	90.91%	Gauges or Dials on Equipment	81.82%	96.30%	Computer	100.00%	100.00%
Gauges or Dials on Equipment	82.05%	90.63%	Scales on Equipment	78.79%	92.31%	Tape Measure	100.00%	75.00%
Protractor	71.79%	75.00%	Advanced Instruments / Instrumentation	75.76%	96.00%	Scales on Equipment	100.00%	75.00%
Calculator	71.79%	75.00%	Calculator	69.70%	100.00%	Calipers	75.00%	100.00%
Jigs	69.23%	92.59%	Calipers	69.70%	95.65%	Gauges or Dials on Equipment	75.00%	100.00%
Calipers	66.67%	96.15%	Computer	66.67%	90.91%	Advanced Instruments / Instrumentation	75.00%	100.00%
Advanced Instruments / Instrumentation	43.59%	100.00%	Protractor	60.61%	80.00%	Protractor	50.00%	100.00%
Computer	38.46%	86.67%	Jigs	48.48%	87.50%	Jigs	50.00%	100.00%
Mobile Equipment	35.90%	92.86%	Mobile Equipment	42.42%	78.57%	Mobile Equipment	50.00%	50.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills [cont.]

Clerical/Sales			Technical			Professional		
Basic Math	Use	Freq	Basic Math	Use	Freq	Basic Math	Use	Freq
Count How Many	90.91%	100.00%	Count How Many	100.00%	100.00%	Add or Subtract Numbers	90.91%	100.00%
Estimate Time	90.91%	100.00%	Add or Subtract Numbers	100.00%	89.47%	Multiply or Divide Decimals	90.91%	100.00%
Add or Subtract Numbers	72.73%	100.00%	Add or Subtract Decimals	94.74%	88.89%	Count How Many	90.91%	100.00%
Multiply or Divide Numbers	63.64%	100.00%	Estimate Time	94.74%	83.33%	Estimate Time	90.91%	100.00%
Add or Subtract Decimals	54.55%	100.00%	Estimate Materials	94.74%	77.78%	Add or Subtract Decimals	81.82%	100.00%
Estimate Materials	54.55%	83.33%	Multiply or Divide Numbers	89.47%	88.24%	Multiply or Divide Numbers	81.82%	100.00%
Multiply or Divide Decimals	45.45%	100.00%	Multiply or Divide Decimals	89.47%	88.24%	Convert Fractions & Decimals	81.82%	88.89%
Multiply or Divide Fractions	27.27%	100.00%	Multiply or Divide Fractions	73.68%	85.71%	Estimate Materials	81.82%	88.89%
Convert Fractions & Decimals	27.27%	66.67%	Convert Fractions & Decimals	73.68%	78.57%	Multiply or Divide Fractions	72.73%	100.00%
Add or Subtract Fractions	18.18%	100.00%	Add or Subtract Fractions	68.42%	84.62%	Add or Subtract Fractions	63.64%	100.00%

Clerical/Sales			Technical			Professional		
Technical Math	Use	Freq	Technical Math	Use	Freq	Technical Math	Use	Freq
Percentage [%]	45.45%	100.00%	Percentage [%]	100.00%	73.68%	Percentage [%]	90.91%	100.00%
Data	45.45%	100.00%	Data	94.74%	94.44%	Data	90.91%	100.00%
Graphs, Charts, Tables	45.45%	100.00%	Graphs, Charts, Tables	94.74%	83.33%	Ratios or Proportions	90.91%	90.00%
Ratios or Proportions	45.45%	80.00%	Problem Solving	84.21%	81.25%	Negative Numbers	90.91%	90.00%
Negative Numbers	45.45%	80.00%	Numerical Specifications	78.95%	93.33%	Graphs, Charts, Tables	90.91%	90.00%
Estimating Solutions	45.45%	80.00%	Lines and Angles	78.95%	80.00%	Problem Solving	81.82%	100.00%
Problem Solving	45.45%	80.00%	2 Dimensional Shapes	78.95%	80.00%	Estimating Solutions	81.82%	88.89%
Probabilities	36.36%	100.00%	3 Dimensional Shapes	78.95%	66.67%	Probabilities	81.82%	55.56%
Statistics	36.36%	75.00%	Negative Numbers	73.68%	85.71%	Numerical Specifications	72.73%	87.50%
Lines and Angles	27.27%	66.67%	Ratios or Proportions	68.42%	84.62%	Statistics	72.73%	75.00%
Scale Drawings	18.18%	50.00%	Scale Drawings	63.16%	83.33%	Scale Drawings	72.73%	62.50%
3 Dimensional Shapes	18.18%	50.00%	Estimating Solutions	63.16%	83.33%	Applied Linear Equations	72.73%	50.00%
Chemical Proportions	18.18%	50.00%	Statistics	63.16%	58.33%	2 Dimensional Shapes	63.64%	85.71%
Formulas	18.18%	50.00%	Probabilities	63.16%	58.33%	Scientific Notations	63.64%	71.43%
Bend Allowances	9.09%	100.00%	Trigonometric Functions	57.89%	63.64%	Lines and Angles	63.64%	57.14%
Right Triangle Relationships	9.09%	100.00%	Right Triangle Relationships	57.89%	63.64%	Signed Numbers and Vectors	63.64%	42.86%
2 Dimensional Shapes	9.09%	100.00%	Uses of Powers and Roots	57.89%	63.64%	Trigonometric Functions	54.55%	83.33%
Convert Hex to Decimal	9.09%	100.00%	Use Concentration Data [p.p.m., g.p.l., etc.]	57.89%	54.55%	Right Triangle Relationships	54.55%	83.33%
Numerical Specifications	9.09%	100.00%	Scientific Notations	47.37%	55.56%	Uses of Powers and Roots	54.55%	83.33%
Uses of Powers and Roots	9.09%	0.00%	Signed Numbers and Vectors	42.11%	37.50%	3 Dimensional Shapes	54.55%	50.00%
Trigonometric Functions			Applied Linear Equations	36.84%	57.14%	Applied Non Linear Equations	54.55%	16.67%
Applied Linear Equations			Bend Allowances	31.58%	33.33%	Use Concentration Data [p.p.m., g.p.l., etc.]	45.45%	80.00%
Applied Non Linear Equations			Applied Non Linear Equations	31.58%	33.33%	Formulas	36.36%	100.00%
Scientific Notations			Formulas	26.32%	60.00%	Bend Allowances	27.27%	100.00%
Signed Numbers and Vectors			Chemical Proportions	10.53%	50.00%	Convert Hex to Decimal	18.18%	50.00%
Use Concentration Data [p.p.m., g.p.l., etc.]			Convert Hex to Decimal	10.53%	50.00%	Chemical Proportions	0.00%	0.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills [cont.]

Clerical/Sales			Technical			Professional		
Measurement Skills	Use	Freq	Measurement Skills	Use	Freq	Measurement Skills	Use	Freq
Measure in Imperial	54.55%	66.67%	Measure in Imperial	78.95%	100.00%	Measure in Imperial	90.91%	100.00%
Measure in Metric	45.45%	80.00%	Precision, Accuracy, Tolerance	73.68%	92.86%	Measure in Metric	81.82%	77.78%
Convert Imperial & Metric Measures	27.27%	100.00%	Measure in Metric	73.68%	85.71%	Convert Imperial & Metric Measures	63.64%	100.00%
Volume	27.27%	100.00%	Convert Imperial & Metric Measures	73.68%	71.43%	Precision, Accuracy, Tolerance	63.64%	100.00%
Precision, Accuracy, Tolerance	18.18%	100.00%	Volume	68.42%	53.85%	Radius	63.64%	85.71%
Radius	9.09%	100.00%	Mass\Weight	57.89%	54.55%	Circumference	63.64%	85.71%
Circumference	9.09%	100.00%	Density	57.89%	54.55%	Time	63.64%	85.71%
Flow	9.09%	100.00%	Flow	57.89%	45.45%	Temperature	54.55%	100.00%
Temperature			Acceleration	52.63%	60.00%	Volume	54.55%	66.67%
Pressure			Radius	47.37%	100.00%	Measure Current / Voltage	54.55%	33.33%
Mass\Weight			Circumference	47.37%	100.00%	Density	45.45%	80.00%
Acceleration			Temperature	47.37%	44.44%	Millivolts/ Milliamps	45.45%	40.00%
Density			Pressure	47.37%	44.44%	Pressure	36.36%	100.00%
Time			Measure Current / Voltage	47.37%	33.33%	Productivity	36.36%	100.00%
Stress			Time	42.11%	87.50%	Flow	36.36%	75.00%
Tension			Millivolts/ Milliamps	42.11%	37.50%	Mass\Weight	36.36%	75.00%
Optical units			Productivity	21.05%	75.00%	Acceleration	36.36%	75.00%
pH			Conductivity	21.05%	25.00%	Capacitance	27.27%	33.33%
Feel in lb.			Stress	15.79%	66.67%	Resistance	27.27%	33.33%
Capacitance			Tension	15.79%	66.67%	Conductivity	27.27%	33.33%
Resistance			Capacitance	15.79%	33.33%	Optical units	27.27%	0.00%
Conductivity			Feel in lb.	15.79%	0.00%	Stress	18.18%	100.00%
Measure Current / Voltage			Resistance	15.79%	0.00%	Tension	18.18%	100.00%
Millivolts/ Milliamps			Optical units	10.53%	0.00%	pH	18.18%	0.00%
Productivity			pH	10.53%	0.00%	Feel in lb.	18.18%	0.00%

Clerical/Sales			Technical			Professional		
Tool Skills	Use	Freq	Tool Skills	Use	Freq	Tool Skills	Use	Freq
For your job do you use?	Use	Freq	Hand Tools	94.74%	94.44%	Hand Tools	90.91%	100.00%
Hand Tools	90.91%	100.00%	Computer	84.21%	100.00%	Computer	90.91%	100.00%
Computer	90.91%	100.00%	Tape Measure	84.21%	87.50%	Calculator	81.82%	100.00%
Tape Measure	90.91%	90.00%	Calculator	78.95%	93.33%	Tape Measure	81.82%	88.89%
Calculator	81.82%	88.89%	Scales on Equipment	57.89%	81.82%	Gauges or Dials on Equipment	72.73%	87.50%
Gauges or Dials on Equipment	45.45%	100.00%	Gauges or Dials on Equipment	57.89%	54.55%	Scales on Equipment	72.73%	75.00%
Scales on Equipment	36.36%	100.00%	Calipers	52.63%	60.00%	Calipers	63.64%	57.14%
Advanced Instruments / Instrumentation	27.27%	100.00%	Protractor	47.37%	44.44%	Advanced Instruments / Instrumentation	54.55%	83.33%
Protractor	9.09%	100.00%	Advanced Instruments / Instrumentation	36.84%	57.14%	Protractor	54.55%	16.67%
Mobile Equipment	9.09%	0.00%	Mobile Equipment	21.05%	25.00%	Mobile Equipment	9.09%	0.00%
			Jigs	15.79%	66.67%	Jigs	0.00%	0.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills [cont.]

Management		
Basic Math	**Use**	**Freq**
Add or Subtract Numbers	100.00%	100.00%
Add or Subtract Decimals	100.00%	100.00%
Multiply or Divide Numbers	100.00%	100.00%
Multiply or Divide Decimals	100.00%	100.00%
Count How Many	87.50%	100.00%
Estimate Time	87.50%	100.00%
Estimate Materials	87.50%	100.00%
Convert Fractions & Decimals	87.50%	71.43%
Multiply or Divide Fractions	75.00%	83.33%
Add or Subtract Fractions	75.00%	66.67%

Management		
Technical Math	**Use**	**Freq**
Negative Numbers	100.00%	75.00%
Problem Solving	100.00%	75.00%
Estimating Solutions	100.00%	62.50%
Data	100.00%	100.00%
Percentage [%]	100.00%	87.50%
Graphs, Charts, Tables	100.00%	87.50%
Statistics	100.00%	87.50%
Ratios or Proportions	87.50%	85.71%
Lines and Angles	87.50%	71.43%
2 Dimensional Shapes	87.50%	71.43%
3 Dimensional Shapes	87.50%	71.43%
Scale Drawings	87.50%	57.14%
Right Triangle Relationships	87.50%	42.86%
Numerical Specifications	75.00%	100.00%
Probabilities	75.00%	50.00%
Trigonometric Functions	75.00%	50.00%
Formulas	62.50%	100.00%
Uses of Powers and Roots	50.00%	100.00%
Scientific Notations	50.00%	75.00%
Applied Linear Equations	50.00%	50.00%
Signed Numbers and Vectors	37.50%	100.00%
Chemical Proportions	37.50%	66.67%
Use Concentration Data [p.p.m., g.p.l., etc.]	37.50%	66.67%
Convert Hex to Decimal	25.00%	0.00%
Bend Allowances	12.50%	100.00%
Applied Non Linear Equations	12.50%	0.00%

RANKED USE AND FREQUENCY OF USE TABLES

Mathematics Skills [cont.]

Management		
Measurement Skills	Use	Freq
Productivity	100.00%	75.00%
Precision, Accuracy, Tolerance	87.50%	100.00%
Measure in Metric	87.50%	71.43%
Volume	87.50%	71.43%
Temperature	87.50%	71.43%
Acceleration	87.50%	57.14%
Measure in Imperial	75.00%	100.00%
Flow	75.00%	83.33%
Pressure	75.00%	66.67%
Mass\Weight	75.00%	66.67%
Convert Imperial & Metric Measures	75.00%	50.00%
Radius	62.50%	100.00%
Circumference	62.50%	100.00%
Time	62.50%	100.00%
Density	62.50%	80.00%
Stress	37.50%	100.00%
Tension	37.50%	100.00%
Optical units	37.50%	33.33%
Conductivity	37.50%	0.00%
Measure Current / Voltage	37.50%	0.00%
Millivolts/ Milliamps	37.50%	0.00%
Capacitance	25.00%	0.00%
Resistance	25.00%	0.00%
pH	12.50%	100.00%
Feel in lb.	12.50%	0.00%

Management		
Tool Skills	Use	Freq
Hand Tools	100.00%	100.00%
Calculator	100.00%	100.00%
Computer	100.00%	100.00%
Tape Measure	100.00%	87.50%
Gauges or Dials on Equipment	75.00%	83.33%
Scales on Equipment	75.00%	66.67%
Advanced Instruments / Instrumentation	62.50%	80.00%
Protractor	50.00%	50.00%
Calipers	50.00%	25.00%
Jigs	37.50%	100.00%
Mobile Equipment	12.50%	100.00%

RANKED USE AND FREQUENCY OF USE TABLES

Communication Skills

Total Workforce			Hourly Workforce			Salaried Workforce		
Writing Skills	Use	Freq	**Writing Skills**	Use	Freq	**Writing Skills**	Use	Freq
Fill in Forms	84.80%	94.34%	**Fill in Forms**	79.17%	89.47%	**Fill in Forms**	96.23%	96.08%
Leave Notes / Memos	82.40%	87.38%	**Write Shift Reports**	77.78%	89.29%	**Write Work Orders**	96.23%	90.20%
Make Drawing / Sketches	75.20%	73.40%	**Make Drawing / Sketches**	63.89%	52.17%	**Shop Queries**	92.45%	97.96%
Keep Track of Hours	73.60%	97.83%	**Keep Track of Hours**	61.11%	95.45%	**Make Drawing / Sketches**	92.45%	81.63%
Write Instructions	62.40%	70.51%	**Write Work Orders**	55.56%	90.00%	**Write Shift Reports**	88.68%	95.74%
Fill in Time Cards	56.80%	98.59%	**Fill in Time Cards**	54.17%	100.00%	**Fill in Time Cards**	66.04%	88.57%
Input Data on Computer	52.80%	93.94%	**Write Letters / Reports**	51.39%	83.78%	**Write Letters / Reports**	66.04%	74.29%
Write Letters / Reports	48.80%	86.89%	**Leave Notes / Memos**	47.22%	61.76%	**Write Safety Reports**	62.26%	78.79%
Write Work Orders	28.00%	82.86%	**Write Instructions**	44.44%	46.88%	**Write Instructions**	54.72%	48.28%
Write Shift Reports	25.60%	78.13%	**Write Incident Reports**	33.33%	50.00%	**Keep Track of Hours**	50.94%	81.48%
Write Incident Reports	24.00%	36.67%	**Shop Queries**	31.94%	69.57%	**Write Incident Reports**	47.17%	52.00%
Write Safety Reports	15.20%	26.32%	**Write Safety Reports**	23.61%	41.18%	**Leave Notes / Memos**	18.87%	90.00%
Shop Queries	12.00%	46.67%	**Input Data on Computer**	11.11%	50.00%	**Input Data on Computer**	7.55%	75.00%
E-Mail	3.20%	100.00%	**E-Mail**	1.39%	100.00%	**E-Mail**	0.00%	0.00%

Total Workforce			Hourly Workforce			Salaried Workforce		
Oral Skills	Use	Freq	**Oral Skills**	Use	Freq	**Oral Skills**	Use	Freq
Ask Questions	97.60%	99.18%	**Follow Verbal Directions**	94.44%	100.00%	**Follow Written Directions**	100.00%	98.15%
Follow Verbal Directions	96.00%	100.00%	**Ask Questions**	94.44%	23.53%	**Take Messages**	100.00%	98.11%
Take Messages	90.40%	92.04%	**Follow Written Directions**	86.11%	74.19%	**Ask Questions**	100.00%	54.72%
Follow Written Directions	88.80%	97.30%	**Take Messages**	84.72%	116.39%	**Use the Telephone**	100.00%	15.09%
Use the Telephone	88.80%	94.59%	**Use the Telephone**	80.56%	22.41%	**Follow Verbal Directions**	98.11%	100.00%
Give Verbal Directions	80.80%	96.04%	**Give Verbal Directions**	75.00%	135.19%	**Give Verbal Directions**	90.57%	104.17%
Give Written Directions	63.20%	82.28%	**Give Written Directions**	54.17%	161.54%	**Give Written Directions**	88.68%	100.00%
Participate in Meetings	48.00%	73.33%	**Participate in Meetings**	40.28%	55.17%	**Speak with Outside People [eg.suppliers]**	81.13%	37.21%
Speak in Small Groups	47.20%	69.49%	**Speak in Small Groups**	40.28%	31.03%	**Speak in Small Groups**	79.25%	50.00%
Speak with Outside People [eg.suppliers]	44.00%	61.82%	**Speak in Large Groups**	31.94%	217.39%	**Participate in Meetings**	73.58%	110.26%
Speak in Large Groups	37.60%	23.40%	**Speak with Outside People [eg.suppliers]**	30.56%	40.91%	**Speak in Large Groups**	69.81%	151.35%

Total Workforce			Hourly Workforce			Salaried Workforce		
Tool Use Skills	Use	Freq	**Tool Use Skills**	Use	Freq	**Tool Use Skills**	Use	Freq
Use the Photocopier	80.00%	85.00%	**Work with Trade Groups**	81.94%	94.92%	**Use the Photocopier**	100.00%	98.15%
Coordinate Work With Other Groups	74.40%	95.70%	**Coordinate Work With Other Groups**	72.22%	92.31%	**Use Mainframe Computer**	98.11%	96.15%
Work with Trade Groups	70.40%	93.18%	**Use the Photocopier**	65.28%	68.09%	**Coordinate Work With Other Groups**	92.45%	83.67%
Use Mainframe Computer	57.60%	95.83%	**Use Hand Signals**	38.89%	75.00%	**Use a Personal Desktop Computer**	90.57%	95.83%
Use a Personal Desktop Computer	52.00%	93.85%	**Use Mainframe Computer**	30.56%	86.36%	**Use the Fax Machine**	81.13%	76.74%
Use the Fax Machine	33.60%	88.10%	**Use a Personal Desktop Computer**	23.61%	88.24%	**Work with Trade Groups**	64.15%	76.47%
Use Hand Signals	32.80%	82.93%	**Use 2 Way Radio**	16.67%	41.67%	**Use the Typewriter**	33.96%	55.56%
Use the Typewriter	16.00%	70.00%	**Use Process Control Computer**	12.50%	100.00%	**Use Hand Signals**	26.42%	92.86%
Use Process Control Computer	15.20%	94.74%	**Use the Fax Machine**	12.50%	44.44%	**Use Process Control Computer**	26.42%	64.29%
Use a Portable Computer	13.60%	52.94%	**Use Remote Control Radio Equipment**	11.11%	62.50%	**Use a Modem**	26.42%	64.29%
Use a Modem	12.00%	73.33%	**Use a Portable Computer**	9.72%	71.43%	**Use a Portable Computer**	24.53%	30.77%
Use 2 Way Radio	10.40%	46.15%	**Use the Typewriter**	9.72%	57.14%	**Use Remote Control Radio Equipment**	9.43%	40.00%
Use Remote Control Radio Equipment	9.60%	58.33%	**Use a Modem**	4.17%	66.67%	**Use 2 Way Radio**	3.77%	50.00%

Total Workforce			Hourly Workforce			Salaried Workforce		
Social Skills	Use	Freq	**Social Skills**	Use	Freq	**Social Skills**	Use	Freq
Work by yourself	72.80%	91.21%	**Work by yourself**	51.39%	78.38%	**Work by yourself**	100.00%	100.00%
Work with a partner or helper	52.80%	72.73%	**Work with a partner or helper**	45.83%	57.58%	**Work as a member of a team**	79.25%	85.71%
Work as a member of a team	47.20%	83.05%	**Work as a member of a team**	29.17%	61.90%	**Work with a partner or helper**	67.92%	80.56%

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RANKED USE AND FREQUENCY OF USE TABLES

Communication Skills[cont.]

Skilled Manual			Skilled Craftsperson			Supervisor		
Writing Skills	Use	Freq	Writing Skills	Use	Freq	Writing Skills	Use	Freq
Write Shift Reports	74.36%	89.66%	Fill in Forms	87.88%	89.66%	Fill in Forms	100.00%	100.00%
Fill in Forms	71.79%	89.29%	Write Shift Reports	81.82%	88.89%	Keep Track of Hours	100.00%	50.00%
Keep Track of Hours	64.10%	92.00%	Make Drawing / Sketches	69.70%	56.52%	Input Data on Computer	100.00%	50.00%
Make Drawing / Sketches	58.97%	47.83%	Write Work Orders	60.61%	90.00%	Leave Notes / Memos	100.00%	25.00%
Fill in Time Cards	56.41%	100.00%	Keep Track of Hours	57.58%	100.00%	Write Instructions	100.00%	25.00%
Write Letters / Reports	53.85%	80.95%	Shop Queries	54.55%	77.78%	Write Letters / Reports	100.00%	25.00%
Write Work Orders	51.28%	90.00%	Fill in Time Cards	51.52%	100.00%	Make Drawing / Sketches	75.00%	100.00%
Leave Notes / Memos	48.72%	52.63%	Write Letters / Reports	48.48%	87.50%	Write Safety Reports	75.00%	66.67%
Write Instructions	41.03%	43.75%	Write Instructions	48.48%	50.00%	Write Work Orders	50.00%	100.00%
Write Incident Reports	28.21%	36.36%	Leave Notes / Memos	45.45%	73.33%	Write Shift Reports	50.00%	100.00%
Write Safety Reports	17.95%	28.57%	Write Incident Reports	39.39%	61.54%	Fill in Time Cards	50.00%	100.00%
Shop Queries	12.82%	40.00%	Write Safety Reports	30.30%	50.00%	Write Incident Reports	50.00%	100.00%
Input Data on Computer	5.13%	100.00%	Input Data on Computer	18.18%	33.33%	Shop Queries	0.00%	0.00%
E-Mail	0.00%	0.00%	E-Mail	3.03%	100.00%	E-Mail	0.00%	0.00%

Skilled Manual			Skilled Craftsperson			Supervisor		
Oral Skills	Use	Freq	Oral Skills	Use	Freq	Oral Skills	Use	Freq
Follow Verbal Directions	94.87%	100.00%	Ask Questions	100.00%	27.27%	Follow Written Directions	100.00%	100.00%
Ask Questions	89.74%	20.00%	Follow Verbal Directions	93.94%	100.00%	Follow Verbal Directions	100.00%	100.00%
Take Messages	79.49%	116.13%	Follow Written Directions	93.94%	80.65%	Take Messages	100.00%	100.00%
Follow Written Directions	79.49%	67.74%	Use the Telephone	93.94%	16.13%	Speak in Small Groups	100.00%	100.00%
Use the Telephone	69.23%	29.63%	Take Messages	90.91%	116.67%	Give Verbal Directions	100.00%	75.00%
Give Verbal Directions	64.10%	152.00%	Give Verbal Directions	87.88%	120.69%	Give Written Directions	100.00%	75.00%
Give Written Directions	48.72%	168.42%	Give Written Directions	60.61%	155.00%	Participate in Meetings	100.00%	75.00%
Speak in Small Groups	35.90%	35.71%	Participate in Meetings	51.52%	58.82%	Ask Questions	100.00%	50.00%
Speak in Large Groups	33.33%	184.62%	Speak in Small Groups	45.45%	26.67%	Use the Telephone	100.00%	25.00%
Participate in Meetings	30.77%	50.00%	Speak in Large Groups	30.30%	260.00%	Speak in Large Groups	75.00%	133.33%
Speak with Outside People [eg.suppliers]	30.77%	41.67%	Speak with Outside People [eg.suppliers]	30.30%	40.00%	Speak with Outside People [eg.suppliers]	50.00%	50.00%

Skilled Manual			Skilled Craftsperson			Supervisor		
Tool Use Skills	Use	Freq	Tool Use Skills	Use	Freq	Tool Use Skills	Use	Freq
Work with Trade Groups	76.92%	96.67%	Work with Trade Groups	87.88%	93.10%	Use the Photocopier	100.00%	100.00%
Coordinate Work With Other Groups	69.23%	92.59%	Coordinate Work With Other Groups	75.76%	92.00%	Use Mainframe Computer	75.00%	100.00%
Use the Photocopier	66.67%	65.38%	Use the Photocopier	63.64%	71.43%	Coordinate Work With Other Groups	75.00%	66.67%
Use Hand Signals	35.90%	78.57%	Use Hand Signals	42.42%	71.43%	Use the Fax Machine	75.00%	33.33%
Use Mainframe Computer	28.21%	90.91%	Use Mainframe Computer	33.33%	81.82%	Use a Personal Desktop Computer	50.00%	100.00%
Use a Personal Desktop Computer	25.64%	90.00%	Use 2 Way Radio	30.30%	30.00%	Work with Trade Groups	50.00%	100.00%
Use the Typewriter	12.82%	60.00%	Use Process Control Computer	24.24%	100.00%	Use Hand Signals	50.00%	50.00%
Use the Fax Machine	12.82%	40.00%	Use a Personal Desktop Computer	21.21%	85.71%	Use 2 Way Radio	50.00%	50.00%
Use Remote Control Radio Equipment	10.26%	100.00%	Use a Portable Computer	12.12%	75.00%	Use Process Control Computer	50.00%	50.00%
Use a Portable Computer	7.69%	66.67%	Use the Fax Machine	12.12%	50.00%	Use the Typewriter	25.00%	0.00%
Use 2 Way Radio	5.13%	100.00%	Use Remote Control Radio Equipment	12.12%	25.00%	Use a Modem	25.00%	0.00%
Use Process Control Computer	2.56%	100.00%	Use the Typewriter	6.06%	50.00%	Use a Portable Computer	0.00%	0.00%
Use a Modem	2.56%	100.00%	Use a Modem	6.06%	50.00%	Use Remote Control Radio Equipment	0.00%	0.00%

Skilled Manual			Skilled Craftsperson			Supervisor		
Social Skills	Use	Freq	Social Skills	Use	Freq	Social Skills	Use	Freq
Work by yourself	84.62%	100.00%	Work by yourself	96.97%	90.63%	Work by yourself	100.00%	100.00%
Work with a partner or helper	82.05%	68.75%	Work with a partner or helper	57.58%	78.95%	Work with a partner or helper	75.00%	100.00%
Work as a member of a team	48.72%	68.42%	Work as a member of a team	39.39%	84.62%	Work as a member of a team	25.00%	100.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Communication Skills[cont.]

Clerical/Sales			Technical			Professional		
Writing Skills	**Use**	**Freq**	**Writing Skills**	**Use**	**Freq**	**Writing Skills**	**Use**	**Freq**
Input Data on Computer	90.91%	100.00%	Fill in Forms	100.00%	94.74%	Fill in Forms	100.00%	100.00%
Fill in Forms	81.82%	88.89%	Input Data on Computer	100.00%	94.74%	Keep Track of Hours	100.00%	100.00%
Leave Notes / Memos	81.82%	88.89%	Write Letters / Reports	89.47%	82.35%	Input Data on Computer	100.00%	100.00%
Write Instructions	81.82%	66.67%	Write Instructions	89.47%	58.82%	Write Instructions	100.00%	81.82%
Write Letters / Reports	72.73%	100.00%	Leave Notes / Memos	84.21%	100.00%	Write Letters / Reports	100.00%	81.82%
Keep Track of Hours	63.64%	85.71%	Keep Track of Hours	84.21%	81.25%	Leave Notes / Memos	90.91%	100.00%
Fill in Time Cards	54.55%	83.33%	Make Drawing / Sketches	84.21%	81.25%	Fill in Time Cards	81.82%	88.89%
Write Work Orders	27.27%	100.00%	Fill in Time Cards	63.16%	83.33%	Make Drawing / Sketches	81.82%	88.89%
Write Shift Reports	27.27%	33.33%	Write Shift Reports	36.84%	42.86%	Write Shift Reports	63.64%	42.86%
Make Drawing / Sketches	27.27%	33.33%	Write Work Orders	31.58%	66.67%	Write Incident Reports	36.36%	0.00%
Write Incident Reports	18.18%	50.00%	Write Incident Reports	26.32%	40.00%	Write Work Orders	27.27%	66.67%
Write Safety Reports	0.00%	0.00%	Write Safety Reports	15.79%	33.33%	E-Mail	18.18%	100.00%
Shop Queries	0.00%	0.00%	E-Mail	5.26%	100.00%	Write Safety Reports	18.18%	50.00%
E-Mail	0.00%	0.00%	Shop Queries	5.26%	0.00%	Shop Queries	0.00%	0.00%

Clerical/Sales			Technical			Professional		
Oral Skills	**Use**	**Freq**	**Oral Skills**	**Use**	**Freq**	**Oral Skills**	**Use**	**Freq**
Ask Questions	100.00%	100.00%	Follow Verbal Directions	105.26%	100.00%	Ask Questions	100.00%	100.00%
Take Messages	100.00%	100.00%	Ask Questions	105.26%	100.00%	Take Messages	100.00%	100.00%
Use the Telephone	100.00%	100.00%	Use the Telephone	105.26%	100.00%	Use the Telephone	100.00%	100.00%
Follow Written Directions	100.00%	90.91%	Follow Written Directions	100.00%	100.00%	Give Written Directions	100.00%	81.82%
Follow Verbal Directions	90.91%	100.00%	Take Messages	100.00%	94.74%	Follow Written Directions	100.00%	72.73%
Give Verbal Directions	90.91%	90.00%	Give Verbal Directions	84.21%	100.00%	Follow Verbal Directions	90.91%	100.00%
Speak with Outside People [eg.suppliers]	72.73%	100.00%	Give Written Directions	84.21%	93.75%	Give Verbal Directions	90.91%	100.00%
Give Written Directions	72.73%	75.00%	Speak in Small Groups	84.21%	50.00%	Participate in Meetings	90.91%	80.00%
Speak in Small Groups	54.55%	50.00%	Speak with Outside People [eg.suppliers]	84.21%	50.00%	Speak with Outside People [eg.suppliers]	90.91%	60.00%
Participate in Meetings	45.45%	60.00%	Speak in Large Groups	68.42%	0.00%	Speak in Large Groups	90.91%	30.00%
Speak in Large Groups	36.36%	0.00%	Participate in Meetings	57.89%	72.73%	Speak in Small Groups	81.82%	66.67%

Clerical/Sales			Technical			Professional		
Tool Use Skills	**Use**	**Freq**	**Tool Use Skills**	**Use**	**Freq**	**Tool Use Skills**	**Use**	**Freq**
Use the Photocopier	100.00%	100.00%	Use Mainframe Computer	100.00%	100.00%	Use the Photocopier	100.00%	100.00%
Use Mainframe Computer	90.91%	100.00%	Use the Photocopier	100.00%	94.74%	Use Mainframe Computer	100.00%	100.00%
Use the Fax Machine	90.91%	80.00%	Use a Personal Desktop Computer	100.00%	94.74%	Coordinate Work With Other Groups	100.00%	72.73%
Use a Personal Desktop Computer	81.82%	100.00%	Coordinate Work With Other Groups	94.74%	88.89%	Use the Fax Machine	90.91%	70.00%
Coordinate Work With Other Groups	81.82%	88.89%	Work with Trade Groups	73.68%	71.43%	Use a Personal Desktop Computer	81.82%	100.00%
Use the Typewriter	63.64%	71.43%	Use the Fax Machine	68.42%	84.62%	Work with Trade Groups	54.55%	66.67%
Use Hand Signals	45.45%	100.00%	Use the Typewriter	42.11%	62.50%	Use a Modem	54.55%	66.67%
Work with Trade Groups	45.45%	80.00%	Use Process Control Computer	31.58%	66.67%	Use a Portable Computer	36.36%	0.00%
Use a Portable Computer	18.18%	0.00%	Use a Portable Computer	26.32%	40.00%	Use Process Control Computer	27.27%	33.33%
Use Process Control Computer	9.09%	100.00%	Use Hand Signals	21.05%	100.00%	Use Hand Signals	18.18%	100.00%
Use a Modem	9.09%	0.00%	Use a Modem	21.05%	100.00%	Use the Typewriter	0.00%	0.00%
Use 2 Way Radio	0.00%	0.00%	Use Remote Control Radio Equipment	15.79%	33.33%	Use 2 Way Radio	0.00%	0.00%
Use Remote Control Radio Equipment	0.00%	0.00%	Use 2 Way Radio	0.00%	0.00%	Use Remote Control Radio Equipment	0.00%	0.00%

Clerical/Sales			Technical			Professional		
Social Skills	**Use**	**Freq**	**Social Skills**	**Use**	**Freq**	**Social Skills**	**Use**	**Freq**
Work by yourself	100.00%	100.00%	Work by yourself	105.26%	100.00%	Work by yourself	100.00%	100.00%
Work as a member of a team	63.64%	100.00%	Work as a member of a team	84.21%	81.25%	Work with a partner or helper	90.91%	90.00%
Work with a partner or helper	54.55%	66.67%	Work with a partner or helper	68.42%	69.23%	Work as a member of a team	90.91%	90.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Communication Skills[cont.]

Management		
Writing Skills	Use	Freq
Fill in Forms	100.00%	100.00%
Keep Track of Hours	100.00%	100.00%
Leave Notes / Memos	100.00%	100.00%
Write Instructions	100.00%	87.50%
Write Letters / Reports	100.00%	62.50%
Make Drawing / Sketches	87.50%	71.43%
Fill in Time Cards	75.00%	100.00%
Input Data on Computer	75.00%	100.00%
Write Shift Reports	62.50%	80.00%
Write Work Orders	62.50%	60.00%
Write Incident Reports	62.50%	40.00%
Write Safety Reports	37.50%	33.33%
E-Mail	12.50%	100.00%
Shop Queries	0.00%	0.00%/0!

Management		
Oral Skills	Use	Freq
Follow Verbal Directions	100.00%	100.00%
Give Verbal Directions	100.00%	100.00%
Ask Questions	100.00%	100.00%
Take Messages	100.00%	100.00%
Participate in Meetings	100.00%	87.50%
Follow Written Directions	100.00%	75.00%
Give Written Directions	100.00%	75.00%
Use the Telephone	87.50%	100.00%
Speak in Small Groups	87.50%	85.71%
Speak with Outside People [eg.suppliers]	87.50%	71.43%
Speak in Large Groups	87.50%	28.57%

Management		
Tool Use Skills	Use	Freq
Use the Photocopier	100.00%	100.00%
Use a Personal Desktop Computer	100.00%	100.00%
Use Mainframe Computer	100.00%	87.50%
Coordinate Work With Other Groups	100.00%	87.50%
Use the Fax Machine	87.50%	85.71%
Work with Trade Groups	87.50%	85.71%
Use Process Control Computer	25.00%	100.00%
Use a Portable Computer	25.00%	100.00%
Use Remote Control Radio Equipment	25.00%	50.00%
Use a Modem	25.00%	50.00%
Use the Typewriter	25.00%	0.00%
Use Hand Signals	12.50%	100.00%
Use 2 Way Radio	0.00%	0.00%

Management		
Social Skills	Use	Freq
Work by yourself	100.00%	100.00%
Work as a member of a team	100.00%	75.00%
Work with a partner or helper	50.00%	60.00%

RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills

Total Workforce			Hourly Workforce			Salaried Workforce		
Information Processing Skills	Use	Freq	Information Processing Skills	Use	Freq	Information Processing Skills	Use	Freq
Process information in a variety of ways	66.40%	98.80%	Make inferences	56.94%	85.37%	Perform system analysis[trouble shooting]	90.57%	75.00%
Make inferences	66.40%	86.75%	Process information in a variety of ways	51.39%	97.30%	Analyze information or data	88.68%	93.62%
Research information or data	65.60%	95.12%	Identify inconsistencies, deficiencies, and contradictions	50.00%	94.44%	Process information in a variety of ways	86.79%	100.00%
Analyze information or data	65.60%	93.90%	Research information or data	50.00%	91.67%	Research information or data	86.79%	97.83%
Form conclusions and generalizations from facts	64.80%	93.83%	Form conclusions and generalizations from facts	48.61%	97.14%	Identify stated and unstated reasons	86.79%	93.48%
Identify inconsistencies, deficiencies, and contradictions	64.80%	91.36%	Analyze information or data	48.61%	94.29%	Form conclusions and generalizations from facts	86.79%	91.30%
Make Decisions based on Information Supplied by Others	64.00%	93.75%	Make Decisions based on Information Supplied by Others	48.61%	94.29%	Engineer solutions	86.79%	89.13%
Recognize associations and connects information	63.20%	92.41%	Recognize associations and connects information	48.61%	91.43%	Make Decisions based on Information Supplied by Others	84.91%	93.33%
Identify stated and unstated reasons	62.40%	88.46%	Summarize and condense information, facts	44.44%	96.88%	Identify inconsistencies, deficiencies, and contradictions	84.91%	88.89%
Evaluate inf. according to set criteria	60.80%	93.42%	Classify facts	44.44%	96.88%	Recognize associations and connects information	83.02%	93.18%
Perform system analysis[trouble shooting]	60.80%	82.89%	Evaluate inf. according to set criteria	44.44%	96.88%	Evaluate inf. according to set criteria	83.02%	90.91%
Summarize and condense information, facts	60.00%	97.33%	Note similarities and differences between facts	44.44%	93.75%	Design systems	83.02%	79.55%
Note similarities and differences between facts	60.00%	96.00%	Make predictions on the basis of patterns in data	44.44%	90.63%	Summarize and condense information, facts	81.13%	97.6
Make predictions on the basis of patterns in data	60.00%	88.00%	Identify stated and unstated reasons	44.44%	81.25%	Note similarities and differences between facts	81.13%	97.6
Classify facts	59.20%	94.59%	Identify main ideas	43.06%	93.55%	Make predictions on the basis of patterns in data	81.13%	86.0
Engineer solutions	58.40%	87.67%	Perform system analysis[trouble shooting]	38.89%	96.43%	Classify facts	79.25%	92.86
Identify main ideas	57.60%	94.44%	Perform technological assessments	37.50%	100.00%	Make inferences	79.25%	88.10
Perform technological assessments	50.40%	88.89%	Engineer solutions	37.50%	85.19%	Identify main ideas	77.36%	95.12
Design systems	49.60%	77.42%	Design systems	25.00%	72.22%	Perform technological assessments	67.92%	88
Design products	30.40%	73.68%	Design products	16.67%	58.33%	Design products	49.06%	80

Total Workforce			Hourly Workforce			Salaried Workforce		
Judgment & Decision Making Skills	Use	Freq	Judgment & Decision Making Skills	Use	Freq	Judgment & Decision Making Skills	Use	Freq
Distinguish between valid and questionable assumptions	68.00%	97.65%	Deal with differing value systems	52.78%	97.37%	Distinguish between valid and questionable assumptions	90.57%	[illegible]
Deal with differing value systems	65.60%	95.12%	Distinguish between valid and questionable assumptions	51.39%	100.00%	Spot inconsistencies and gaps in information	88.68%	93.62
Recognize evidence and check it	65.60%	93.90%	Recognize evidence and check it	51.39%	94.59%	Gather and organize data	86.79%	[illegible]
Spot inconsistencies and gaps in information	64.80%	95.06%	Evaluate others judgments	50.00%	94.44%	Decide whether statements contradict each other	86.79%	[illegible]
Evaluate others judgments	64.80%	93.83%	Identify facts, opinions, and reasoned arguments	48.61%	100.00%	Recognize evidence and check it	84.91%	93.1
Gather and organize data	63.20%	98.73%	Spot inconsistencies and gaps in information	47.22%	97.06%	Evaluate others judgments	84.91%	93.3
Identify facts, opinions, and reasoned arguments	63.20%	94.94%	Gather and organize data	45.83%	100.00%	Deal with differing value systems	83.02%	93.18
Decide whether statements contradict each other	63.20%	93.67%	Decide whether statements contradict each other	45.83%	90.91%	Identify facts, opinions, and reasoned arguments	83.02%	90.91

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RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Total Workforce			Hourly Workforce			Salaried Workforce		
Problem Solving Skills	Use	Freq	Problem Solving Skills	Use	Freq	Problem Solving Skills	Use	Freq
Solve problems on your own	64.00%	97.50%	Determine the attributes of a problem	48.61%	100.00%	Solve problems on your own	88.68%	95.74%
Determine the attributes of a problem	64.00%	97.50%	Formulate questions about the problem	48.61%	100.00%	Direct others in the application of the solution	86.79%	82.61%
Clarify the problem for others	64.00%	96.25%	Clarify the problem for others	48.61%	94.29%	Clarify the problem for others	84.91%	97.78%
Identify general problems	63.20%	97.47%	Identify general problems	47.22%	100.00%	Identify general problems	84.91%	95.56%
Formulate questions about the problem	63.20%	97.47%	Solve problems on your own	45.83%	100.00%	Determine the attributes of a problem	84.91%	95.56%
Choose solutions as an individual	61.60%	96.10%	Choose solutions as an individual	45.83%	93.94%	Choose solutions as an individual	83.02%	97.73%
Formulate solutions	60.80%	93.42%	integrate inf. about the problem	44.44%	100.00%	Formulate questions about the problem	83.02%	95.45%
Examine and rank solutions	60.80%	89.47%	Examine and rank solutions	44.44%	96.88%	Formulate solutions	83.02%	93.18%
Direct others in the application of the solution	60.80%	82.89%	Formulate solutions	44.44%	93.75%	Examine and rank solutions	83.02%	84.09%
integrate inf. about the problem	59.20%	93.24%	Seek acceptance of solutions	44.44%	93.75%	Seek acceptance of solutions	79.25%	92.86%
Seek acceptance of solutions	59.20%	93.24%	Solve problems as a member of a team	44.44%	87.50%	Monitor solutions	79.25%	90.48%
Monitor solutions	58.40%	90.41%	Monitor solutions	43.06%	90.32%	integrate inf. about the problem	79.25%	88.10%
Solve problems as a member of a team	57.60%	84.72%	Direct others in the application of the solution	41.67%	83.33%	Choose solutions as a member of a team	77.36%	75.61%
Choose solutions as a member of a team	55.20%	81.16%	Choose solutions as a member of a team	38.89%	89.29%	Solve problems as a member of a team	75.47%	82.50%
Formulate hypotheses for testing	49.60%	88.71%	Formulate hypotheses for testing	37.50%	92.59%	Evaluate hypotheses	67.92%	83.33%
Evaluate hypotheses	49.60%	87.10%	Figure out experiments to test hypotheses	37.50%	92.59%	Formulate hypotheses for testing	66.04%	85.71%
Figure out experiments to test hypotheses	48.80%	86.89%	Evaluate hypotheses	36.11%	92.31%	Figure out experiments to test hypotheses	64.15%	82.35%

Total Workforce			Hourly Workforce			Salaried Workforce		
Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq	Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq	Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq
Notice qualities of things: how things differ or are alike	67.20%	98.81%	Notice qualities of things: how things differ or are alike	51.39%	100.00%	Distinguish fact from opinion	90.57%	95.83%
Distinguish fact from opinion	67.20%	97.62%	Distinguish fact from opinion	50.00%	100.00%	Judge the credibility of sources	90.57%	91.67%
Determine the meaning of terms and statements	66.40%	97.59%	Determine the meaning of terms and statements	50.00%	97.22%	Determine the meaning of terms and statements	88.68%	97.87%
Distinguish relevant from irrelevant data	66.40%	92.77%	Notice successive stages in which things occur	50.00%	94.44%	Notice qualities of things: how things differ or are alike	88.68%	97.87%
Judge the credibility of sources	66.40%	90.36%	Distinguish relevant from irrelevant data	50.00%	91.67%	Identify and sort things into classes	88.68%	93.62%
Notice successive stages in which things occur	64.80%	95.06%	Judge the credibility of sources	48.61%	88.57%	Distinguish relevant from irrelevant data	88.68%	93.62%
Identify and sort things into classes	64.00%	96.25%	Use evidence to examine the validity of beliefs	47.22%	91.18%	Recognize analogies and reason by analogy	88.68%	91.49%
Judge whether a definition is adequate,	63.20%	87.34%	Judge whether a definition is adequate,	47.22%	76.47%	Examine arguments for ambiguity in the line of reasoning	86.79%	86.96%
Break down wholes into component parts	61.60%	98.70%	Identify and sort things into classes	45.83%	100.00%	Break down wholes into component parts	84.91%	100.00%
Use syllogistic reasoning	61.60%	97.40%	Use syllogistic reasoning	45.83%	96.97%	Judge whether a definition is adequate,	84.91%	95.56%
Analyze and evaluate arguments	61.60%	93.51%	Detect bias, stereotypes	45.83%	84.85%	Notice successive stages in which things occur	84.91%	95.56%
Use evidence to examine the validity of beliefs	61.60%	88.31%	Break down wholes into component parts	44.44%	96.88%	Analyze and evaluate arguments	84.91%	93.33%
Detect bias, stereotypes	61.60%	87.01%	Analyze and evaluate arguments	44.44%	93.75%	Use syllogistic reasoning	83.02%	97.73%
Recognize analogies and reason by analogy	60.00%	92.00%	Connect causes and effects	41.67%	86.67%	Detect bias, stereotypes	83.02%	88.64%
Examine arguments for ambiguity in the line of reasoning	60.00%	85.33%	Examine arguments for ambiguity in the line of reasoning	40.28%	82.76%	Connect causes and effects	81.13%	97.67%
Connect causes and effects	58.40%	93.15%	Recognize analogies and reason by analogy	38.89%	92.86%	Use evidence to examine the validity of beliefs	81.13%	86.05%
Use scientific method as a process of validation	48.80%	75.41%	Represent ideas as three-dimensional images	31.94%	86.96%	Use scientific method as a process of validation	71.70%	71.05%
Represent ideas as three-dimensional images	42.40%	83.02%	Use scientific method as a process of validation	31.94%	82.61%	Represent ideas as three-dimensional images	56.60%	80.00%

RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Total Workforce			Hourly Workforce			Salaried Workforce		
Creative Thinking Skills	Use	Freq	Creative Thinking Skills	Use	Freq	Creative Thinking Skills	Use	Freq
Uses intuition	87.20%	93.58%	Uses intuition	42.40%	98.57%	Uses intuition	100.00%	96.43%
Generates ideas	84.00%	94.29%	Uses imagery	41.60%	98.08%	Identifies and examines alternatives	100.00%	96.23%
Uses insight	83.20%	97.12%	Uses insight	41.60%	98.08%	Generates ideas	100.00%	94.34%
Uses imagery	82.40%	98.06%	Generates ideas	41.60%	94.23%	Ranks alternatives and chooses the best	100.00%	94.34%
Analyzes open-ended situations and problems	81.60%	91.18%	Makes unusual connections between facts	41.60%	82.69%	Extrapolates from limited facts	100.00%	88.68%
Makes unusual connections between facts	81.60%	85.29%	Identifies relationships between situations that may appear unconnected	40.80%	88.39%	Uses insight	98.11%	96.15%
Identifies relationships between situations that may appear unconnected	80.80%	84.16%	Analyzes open-ended situations and problems	40.00%	90.00%	Analyzes open-ended situations and problems	98.11%	92.31%
Identifies and examines alternatives	80.00%	95.00%	Lists attributes of objects and situations	37.60%	93.62%	Uses imagery	96.23%	98.04%
Extrapolates from limited facts	79.20%	83.84%	Identifies and examines alternatives	37.60%	93.62%	Synthesizes from various sources to form a new whole	96.23%	90.20%
Lists attributes of objects and situations	77.60%	93.81%	Extrapolates from limited facts	36.80%	78.26%	Lists attributes of objects and situations	94.34%	94.00%
Ranks alternatives and chooses the best	76.00%	92.63%	Elaborates details	35.20%	77.27%	Identifies relationships between situations that may appear unconnected	94.34%	88.00%
Tolerate ambiguity, hold conclusion off to search for innovative ideas	75.20%	74.47%	Tolerate ambiguity, hold conclusion off to search for innovative ideas	35.20%	72.73%	Makes unusual connections between facts	94.34%	88.00%
Elaborates details	74.40%	83.87%	Uses metacognition	34.40%	67.44%	Tolerate ambiguity, hold conclusion off to search for innovative ideas	94.34%	[illegible]
Synthesizes from various sources to form a new whole	73.60%	82.61%	Generates multiple ideas to support multiple viewpoints	34.40%	53.49%	Elaborates details	92.45%	89.80%
Uses metacognition	72.80%	78.02%	Ranks alternatives and chooses the best	33.60%	90.48%	Uses metacognition	90.57%	[illegible]
Generates multiple ideas to support multiple viewpoints	71.20%	67.42%	Synthesizes from various sources to form a new whole	32.80%	73.17%	Generates multiple ideas to support multiple viewpoints	86.79%	80.43%
Uses metadata	49.60%	78.97%	Uses metadata	17.60%	81.82%	Uses metadata	75.47%	[illegible]

Skilled Manual			Skilled Craftsperson			Supervisor		
Information Processing	Use	Freq	Information Processing	Use	Freq	Information Processing	Use	Freq
Make Decisions based on Information Supplied by Others	51.28%	100.00%	Make inferences	72.73%	91.67%	Process information in a variety of ways	100.00%	100.00%
Process information in a variety of ways	51.28%	95.00%	Process information in a variety of ways	51.52%	100.00%	Analyze information or data	100.00%	[illegible]
Identify inconsistencies, deficiencies, and contradictions	51.28%	95.00%	Form conclusions and generalizations from facts	51.52%	94.12%	Form conclusions and generalizations from facts	100.00%	[illegible]
Research information or data	48.72%	94.74%	Research information or data	51.52%	88.24%	Make predictions on the basis of patterns in data	100.00%	[illegible]
Analyze information or data	48.72%	89.47%	Recognize associations and connects information	51.52%	82.35%	Evaluate inf. according to set criteria	100.00%	[illegible]
Recognize associations and connects information	46.15%	100.00%	Analyze information or data	48.48%	100.00%	Make Decisions based on Information Supplied by Others	100.00%	[illegible]
Form conclusions and generalizations from facts	46.15%	100.00%	Identify inconsistencies, deficiencies, and contradictions	48.48%	93.75%	Engineer solutions	100.00%	[illegible]
Evaluate inf. according to set criteria	46.15%	100.00%	Summarize and condense information, facts	48.48%	93.75%	Design systems	100.00%	[illegible]
Note similarities and differences between facts	46.15%	94.44%	Identify main ideas	48.48%	87.50%	Research information or data	75.00%	100.00%
Identify stated and unstated reasons	46.15%	88.89%	Perform system analysis[trouble shooting]	45.45%	93.33%	Perform system analysis[trouble shooting]	75.00%	100.00%
Classify facts	43.59%	100.00%	Classify facts	45.45%	93.33%	Design products	75.00%	[illegible]
Make predictions on the basis of patterns in data	43.59%	94.12%	Make predictions on the basis of patterns in data	45.45%	86.67%	Perform technological assessments	75.00%	[illegible]
Make inferences	43.59%	76.47%	Make Decisions based on Information Supplied by Others	45.45%	86.67%	Identify inconsistencies, deficiencies, and contradictions	75.00%	[illegible]
Summarize and condense information, facts	41.03%	100.00%	Perform technological assessments	42.42%	100.00%	Make inferences	75.00%	[illegible]
Identify main ideas	38.46%	100.00%	Evaluate inf. according to set criteria	42.42%	92.86%	Identify main ideas	75.00%	[illegible]
Engineer solutions	38.46%	93.33%	Note similarities and differences between facts	42.42%	92.86%	Note similarities and differences between facts	75.00%	[illegible]
Perform system analysis[trouble shooting]	33.33%	100.00%	Identify stated and unstated reasons	42.42%	71.43%	Classify facts	75.00%	[illegible]
Perform technological assessments	33.33%	100.00%	Engineer solutions	36.36%	75.00%	Identify stated and unstated reasons	75.00%	[illegible]
Design systems	25.64%	80.00%	Design systems	24.24%	62.50%	Recognize associations and connects information	75.00%	[illegible]
Design products	20.51%	50.00%	Design products	12.12%	75.00%	Summarize and condense information, facts	50.00%	100.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Skilled Manual			Skilled Craftsperson			Supervisor		
Judgment & Decision Making Skills	Use	Freq	Judgment & Decision Making Skills	Use	Freq	Judgment & Decision Making Skills	Use	Freq
Distinguish between valid and questionable assumptions	51.28%	100.00%	Deal with differing value systems	60.61%	95.00%	Gather and organize data	100.00%	100.00%
Recognize evidence and check it	51.28%	95.00%	Distinguish between valid and questionable assumptions	51.52%	100.00%	Distinguish between valid and questionable assumptions	100.00%	75.00%
Evaluate others judgments	51.28%	95.00%	Recognize evidence and check it	51.52%	94.12%	Decide whether statements contradict each other	100.00%	75.00%
Identify facts, opinions, and reasoned arguments	48.72%	100.00%	Identify facts, opinions, and reasoned arguments	48.48%	100.00%	Spot inconsistencies and gaps in information	100.00%	50.00%
Deal with differing value systems	46.15%	100.00%	Spot inconsistencies and gaps in information	48.48%	100.00%	Identify facts, opinions, and reasoned arguments	75.00%	66.67%
Spot inconsistencies and gaps in information	46.15%	94.44%	Gather and organize data	48.48%	100.00%	Recognize evidence and check it	75.00%	66.67%
Decide whether statements contradict each other	46.15%	88.89%	Evaluate others judgments	48.48%	93.75%	Deal with differing value systems	75.00%	66.67%
Gather and organize data	43.59%	100.00%	Decide whether statements contradict each other	45.45%	93.33%	Evaluate others judgments	75.00%	66.67%

Skilled Manual			Skilled Craftsperson			Supervisor		
Problem Solving Skills	Use	Freq	Problem Solving Skills	Use	Freq	Problem Solving Skills	Use	Freq
Identify general problems	48.72%	100.00%	Solve problems on your own	48.48%	100.00%	Identify general problems	100.00%	100.00%
Determine the attributes of a problem	48.72%	100.00%	Determine the attributes of a problem	48.48%	100.00%	Determine the attributes of a problem	100.00%	100.00%
Formulate questions about the problem	48.72%	100.00%	Clarify the problem for others	48.48%	100.00%	Clarify the problem for others	100.00%	100.00%
Choose solutions as an individual	48.72%	94.74%	Formulate questions about the problem	48.48%	100.00%	Formulate questions about the problem	100.00%	100.00%
Clarify the problem for others	48.72%	89.47%	Identify general problems	45.45%	100.00%	Formulate solutions	100.00%	100.00%
integrate inf. about the problem	46.15%	100.00%	Seek acceptance of solutions	45.45%	93.33%	Choose solutions as an individual	100.00%	100.00%
Examine and rank solutions	46.15%	100.00%	Formulate solutions	45.45%	86.67%	Seek acceptance of solutions	100.00%	100.00%
Solve problems as a member of a team	46.15%	83.33%	Direct others in the application of the solution	45.45%	86.67%	Monitor solutions	100.00%	100.00%
Solve problems on your own	43.59%	100.00%	Monitor solutions	45.45%	86.67%	Solve problems on your own	100.00%	75.00%
Formulate solutions	43.59%	100.00%	integrate inf. about the problem	42.42%	100.00%	integrate inf. about the problem	100.00%	75.00%
Seek acceptance of solutions	43.59%	94.12%	Solve problems as a member of a team	42.42%	92.86%	Examine and rank solutions	100.00%	75.00%
Monitor solutions	41.03%	93.75%	Examine and rank solutions	42.42%	92.86%	Direct others in the application of the solution	100.00%	75.00%
Direct others in the application of the solution	38.46%	80.00%	Choose solutions as an individual	42.42%	92.86%	Formulate hypotheses for testing	75.00%	100.00%
Formulate hypotheses for testing	35.90%	92.86%	Choose solutions as a member of a team	42.42%	92.86%	Evaluate hypotheses	75.00%	100.00%
Figure out experiments to test hypotheses	35.90%	92.86%	Formulate hypotheses for testing	39.39%	92.31%	Figure out experiments to test hypotheses	75.00%	100.00%
Choose solutions as a member of a team	35.90%	85.71%	Evaluate hypotheses	39.39%	92.31%	Solve problems as a member of a team	75.00%	66.67%
Evaluate hypotheses	33.33%	92.31%	Figure out experiments to test hypotheses	39.39%	92.31%	Choose solutions as a member of a team	75.00%	66.67%

RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Skilled Manual			Skilled Craftsperson			Supervisor		
Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq	Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq	Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq
Determine the meaning of terms and statements	51.28%	100.00%	Notice qualities of things: how things differ or are alike	51.52%	100.00%	Determine the meaning of terms and statements	100.00%	100.00%
Notice qualities of things: how things differ or are alike	51.28%	100.00%	Distinguish fact from opinion	51.52%	100.00%	Distinguish fact from opinion	100.00%	80.00%
Distinguish relevant from irrelevant data	51.28%	100.00%	Use syllogistic reasoning	51.52%	94.12%	Notice qualities of things: how things differ or are alike	100.00%	75.00%
Notice successive stages in which things occur	48.72%	100.00%	Notice successive stages in which things occur	51.52%	88.24%	Notice successive stages in which things occur	100.00%	75.00%
Distinguish fact from opinion	48.72%	100.00%	Judge the credibility of sources	51.52%	76.47%	Recognize analogies and reason by analogy	100.00%	75.00%
Break down wholes into component parts	48.72%	94.74%	Judge whether a definition is adequate,	51.52%	70.59%	Detect bias, stereotypes	100.00%	75.00%
Detect bias, stereotypes	48.72%	84.21%	Identify and sort things into classes	48.48%	100.00%	Analyze and evaluate arguments	100.00%	75.00%
Judge the credibility of sources	46.15%	100.00%	Determine the meaning of terms and statements	48.48%	93.75%	Identify and sort things into classes	100.00%	50.00%
Use evidence to examine the validity of beliefs	46.15%	88.89%	Use evidence to examine the validity of beliefs	48.48%	93.75%	Judge the credibility of sources	100.00%	50.00%
Identify and sort things into classes	43.59%	100.00%	Analyze and evaluate arguments	48.48%	93.75%	Distinguish relevant from irrelevant data	100.00%	50.00%
Judge whether a definition is adequate,	43.59%	82.35%	Distinguish relevant from irrelevant data	48.48%	81.25%	Break down wholes into component parts	75.00%	100.00%
Use syllogistic reasoning	41.03%	100.00%	Connect causes and effects	45.45%	86.67%	Connect causes and effects	75.00%	100.00%
Analyze and evaluate arguments	41.03%	93.75%	Recognize analogies and reason by analogy	45.45%	86.67%	Use scientific method as a process of validation	75.00%	100.00%
Connect causes and effects	38.46%	86.67%	Detect bias, stereotypes	42.42%	85.71%	Examine arguments for ambiguity in the line of reasoning	75.00%	100.00%
Examine arguments for ambiguity in the line of reasoning	38.46%	86.67%	Examine arguments for ambiguity in the line of reasoning	42.42%	78.57%	Use syllogistic reasoning	75.00%	100.00%
Use scientific method as a process of validation	35.90%	85.71%	Break down wholes into component parts	39.39%	100.00%	Use evidence to examine the validity of beliefs	50.00%	100.00%
Recognize analogies and reason by analogy	33.33%	100.00%	Represent ideas as three-dimensional images	30.30%	80.00%	Represent ideas as three-dimensional images	50.00%	50.00%
Represent ideas as three-dimensional images	33.33%	92.31%	Use scientific method as a process of validation	27.27%	77.78%	Judge whether a definition is adequate,	50.00%	50.00%

Skilled Manual			Skilled Craftsperson			Supervisor		
Creative Thinking Skills	Use	Freq	Creative Thinking Skills	Use	Freq	Creative Thinking Skills	Use	Freq
Uses intuition	74.36%	93.10%	Identifies relationships between situations that may appear unconnected	75.76%	84.00%	Uses intuition	100.00%	100.00%
Uses imagery	71.79%	100.00%	Generates ideas	72.73%	100.00%	Uses imagery	100.00%	100.00%
Uses insight	71.79%	96.43%	Uses insight	72.73%	100.00%	Analyzes open-ended situations and problems	100.00%	75.00%
Generates ideas	71.79%	89.29%	Uses imagery	72.73%	95.83%	Lists attributes of objects and situations	100.00%	75.00%
Makes unusual connections between facts	71.79%	78.57%	Analyzes open-ended situations and problems	72.73%	91.67%	Generates ideas	100.00%	75.00%
Analyzes open-ended situations and problems	66.67%	88.46%	Uses intuition	72.73%	87.50%	Identifies and examines alternatives	100.00%	75.00%
Identifies and examines alternatives	66.67%	88.46%	Makes unusual connections between facts	72.73%	87.50%	Ranks alternatives and chooses the best	100.00%	75.00%
Identifies relationships between situations that may appear unconnected	66.67%	76.92%	Lists attributes of objects and situations	69.70%	91.30%	Identifies relationships between situations that may appear unconnected	100.00%	75.00%
Extrapolates from limited facts	64.10%	80.00%	Ranks alternatives and chooses the best	66.67%	95.45%	Makes unusual connections between facts	100.00%	75.00%
Tolerate ambiguity, hold conclusion off to search for innovative ideas	64.10%	72.00%	Identifies and examines alternatives	63.64%	100.00%	Tolerate ambiguity, hold conclusion off to search for innovative ideas	100.00%	75.00%
Lists attributes of objects and situations	61.54%	95.83%	Extrapolates from limited facts	63.64%	76.19%	Synthesizes from various sources to form a new whole	100.00%	75.00%
Elaborates details	61.54%	83.33%	Uses metacognition	63.64%	61.90%	Extrapolates from limited facts	100.00%	60.00%
Synthesizes from various sources to form a new whole	56.41%	77.27%	Generates multiple ideas to support multiple viewpoints	63.64%	52.38%	Uses metacognition	100.00%	50.00%
Uses metacognition	56.41%	72.73%	Elaborates details	60.61%	70.00%	Generates multiple ideas to support multiple viewpoints	75.00%	100.00%
Generates multiple ideas to support multiple viewpoints	56.41%	54.55%	Tolerate ambiguity, hold conclusion off to search for innovative ideas	57.58%	73.68%	Uses insight	75.00%	100.00%
Ranks alternatives and chooses the best	51.28%	85.00%	Synthesizes from various sources to form a new whole	57.58%	68.42%	Elaborates details	75.00%	100.00%
Uses metadata	23.08%	100.00%	Uses metadata	39.39%	69.23%	Uses metadata	75.00%	0.00%

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RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Clerical/Sales			Technical			Professional		
Information Processing Skills	Use	Freq	Information Processing Skills	Use	Freq	Information Processing Skills	Use	Freq
Process information in a variety of ways	81.82%	100.00%	Process information in a variety of ways	84.21%	100.00%	Research information or data	100.00%	100.00%
Identify inconsistencies, deficiencies, and contradictions	81.82%	88.89%	Research information or data	84.21%	100.00%	Analyze information or data	100.00%	100.00%
Identify stated and unstated reasons	81.82%	88.89%	Analyze information or data	84.21%	100.00%	Summarize and condense information, facts	100.00%	100.00%
Perform system analysis[trouble shooting]	81.82%	44.44%	Recognize associations and connects information	84.21%	100.00%	Classify facts	100.00%	100.00%
Research information or data	72.73%	87.50%	Make Decisions based on Information Supplied by Others	84.21%	100.00%	Form conclusions and generalizations from facts	100.00%	100.00%
Summarize and condense information, facts	72.73%	87.50%	Evaluate inf. according to set criteria	84.21%	93.75%	Evaluate inf. according to set criteria	100.00%	100.00%
Form conclusions and generalizations from facts	72.73%	75.00%	Make predictions on the basis of patterns in data	84.21%	87.50%	Make Decisions based on Information Supplied by Others	100.00%	100.00%
Make Decisions based on Information Supplied by Others	72.73%	75.00%	Design systems	84.21%	81.25%	Engineer solutions	100.00%	91.67%
Make inferences	63.64%	100.00%	Perform system analysis[trouble shooting]	84.21%	75.00%	Identify inconsistencies, deficiencies, and contradictions	100.00%	91.67%
Note similarities and differences between facts	63.64%	100.00%	Engineer solutions	78.95%	100.00%	Identify main ideas	90.91%	100.00%
Identify main ideas	63.64%	85.71%	Identify main ideas	78.95%	100.00%	Note similarities and differences between facts	90.91%	100.00%
Recognize associations and connects information	63.64%	85.71%	Summarize and condense information, facts	78.95%	100.00%	Identify stated and unstated reasons	90.91%	100.00%
Analyze information or data	63.64%	71.43%	Note similarities and differences between facts	78.95%	100.00%	Recognize associations and connects information	90.91%	100.00%
Engineer solutions	63.64%	71.43%	Identify stated and unstated reasons	78.95%	100.00%	Make inferences	90.91%	90.00%
Classify facts	54.55%	100.00%	Form conclusions and generalizations from facts	78.95%	100.00%	Perform technological assessments	90.91%	70.00%
Make predictions on the basis of patterns in data	54.55%	83.33%	Classify facts	78.95%	93.33%	Process information in a variety of ways	81.82%	100.00%
Design systems	54.55%	66.67%	Make inferences	78.95%	86.67%	Design systems	81.82%	88.89%
Evaluate inf. according to set criteria	45.45%	80.00%	Identify inconsistencies, deficiencies, and contradictions	73.68%	92.86%	Perform system analysis[trouble shooting]	81.82%	88.89%
Perform technological assessments	36.36%	75.00%	Perform technological assessments	47.37%	88.89%	Make predictions on the basis of patterns in data	81.82%	88.89%
Design products	9.09%	100.00%	Design products	47.37%	77.78%	Design products	63.64%	85.71%

Clerical/Sales			Technical			Professional		
Judgment & Decision Making Skills	Use	Freq	Judgment & Decision Making Skills	Use	Freq	Judgment & Decision Making Skills	Use	Freq
Recognize evidence and check it	81.82%	100.00%	Distinguish between valid and questionable assumptions	84.21%	100.00%	Gather and organize data	100.00%	100.00%
Spot inconsistencies and gaps in information	81.82%	100.00%	Spot inconsistencies and gaps in information	84.21%	93.75%	Distinguish between valid and questionable assumptions	100.00%	100.00%
Decide whether statements contradict each other	81.82%	100.00%	Deal with differing value systems	78.95%	100.00%	Decide whether statements contradict each other	100.00%	100.00%
Deal with differing value systems	72.73%	100.00%	Evaluate others judgments	78.95%	100.00%	Evaluate others judgments	100.00%	100.00%
Distinguish between valid and questionable assumptions	72.73%	100.00%	Identify facts, opinions, and reasoned arguments	78.95%	93.33%	Identify facts, opinions, and reasoned arguments	90.91%	100.00%
Gather and organize data	72.73%	100.00%	Recognize evidence and check it	78.95%	93.33%	Recognize evidence and check it	90.91%	100.00%
Evaluate others judgments	72.73%	100.00%	Gather and organize data	78.95%	93.33%	Deal with differing value systems	90.91%	100.00%
Identify facts, opinions, and reasoned arguments	72.73%	75.00%	Decide whether statements contradict each other	73.68%	100.00%	Spot inconsistencies and gaps in information	90.91%	100.00%

RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Clerical/Sales			Technical			Professional		
Problem Solving Skills	Use	Freq	Problem Solving Skills	Use	Freq	Problem Solving Skills	Use	Freq
Solve problems on your own	81.82%	88.89%	Solve problems on your own	84.21%	100.00%	Solve problems on your own	100.00%	100.00%
Choose solutions as an individual	72.73%	100.00%	Clarify the problem for others	84.21%	100.00%	Identify general problems	100.00%	100.00%
Seek acceptance of solutions	72.73%	100.00%	Identify general problems	84.21%	93.75%	Determine the attributes of a problem	100.00%	100.00%
Identify general problems	72.73%	87.50%	Determine the attributes of a problem	84.21%	93.75%	Clarify the problem for others	100.00%	100.00%
Determine the attributes of a problem	72.73%	87.50%	Direct others in the application of the solution	84.21%	81.25%	Formulate questions about the problem	100.00%	100.00%
Clarify the problem for others	72.73%	87.50%	Formulate questions about the problem	78.95%	93.33%	integrate inf. about the problem	100.00%	100.00%
Formulate questions about the problem	72.73%	87.50%	Formulate solutions	78.95%	86.67%	Formulate solutions	100.00%	100.00%
Formulate solutions	72.73%	87.50%	Examine and rank solutions	78.95%	73.33%	Evaluate hypotheses	100.00%	90.91%
Examine and rank solutions	72.73%	87.50%	Choose solutions as an individual	73.68%	100.00%	Figure out experiments to test hypotheses	100.00%	90.91%
Choose solutions as a member of a team	72.73%	75.00%	Monitor solutions	73.68%	92.86%	Seek acceptance of solutions	100.00%	90.91%
Direct others in the application of the solution	72.73%	75.00%	Solve problems as a member of a team	73.68%	78.57%	Examine and rank solutions	100.00%	90.91%
Solve problems as a member of a team	63.64%	85.71%	integrate inf. about the problem	73.68%	78.57%	Choose solutions as an individual	100.00%	90.91%
integrate inf. about the problem	63.64%	85.71%	Choose solutions as a member of a team	73.68%	71.43%	Monitor solutions	100.00%	90.91%
Monitor solutions	63.64%	71.43%	Seek acceptance of solutions	68.42%	84.62%	Direct others in the application of the solution	100.00%	81.82%
Evaluate hypotheses	45.45%	80.00%	Formulate hypotheses for testing	63.16%	66.67%	Formulate hypotheses for testing	90.91%	100.00%
Formulate hypotheses for testing	36.36%	100.00%	Evaluate hypotheses	57.89%	72.73%	Solve problems as a member of a team	90.91%	90.00%
Figure out experiments to test hypotheses	36.36%	100.00%	Figure out experiments to test hypotheses	52.63%	60.00%	Choose solutions as a member of a team	90.91%	80.00%

Clerical/Sales			Technical			Professional		
Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq	Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq	Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq
Notice qualities of things: how things differ or are alike	81.82%	100.00%	Distinguish relevant from irrelevant data	84.21%	100.00%	Determine the meaning of terms and statements	100.00%	100.00%
Recognize analogies and reason by analogy	81.82%	100.00%	Identify and sort things into classes	84.21%	93.75%	Notice qualities of things: how things differ or are alike	100.00%	100.00%
Distinguish fact from opinion	81.82%	100.00%	Detect bias, stereotypes	84.21%	93.75%	Notice successive stages in which things occur	100.00%	100.00%
Judge whether a definition is adequate,	81.82%	100.00%	Determine the meaning of terms and statements	78.95%	100.00%	Break down wholes into component parts	100.00%	100.00%
Determine the meaning of terms and statements	81.82%	88.89%	Notice qualities of things: how things differ or are alike	78.95%	100.00%	Identify and sort things into classes	100.00%	100.00%
Judge the credibility of sources	81.82%	88.89%	Break down wholes into component parts	78.95%	100.00%	Recognize analogies and reason by analogy	100.00%	100.00%
Examine arguments for ambiguity in the line of reasoning	81.82%	88.89%	Judge the credibility of sources	78.95%	100.00%	Judge the credibility of sources	100.00%	91.67%
Break down wholes into component parts	72.73%	100.00%	Distinguish fact from opinion	78.95%	100.00%	Use evidence to examine the validity of beliefs	100.00%	90.91%
Identify and sort things into classes	72.73%	100.00%	Connect causes and effects	78.95%	100.00%	Judge whether a definition is adequate,	100.00%	90.91%
Distinguish relevant from irrelevant data	72.73%	100.00%	Judge whether a definition is adequate,	78.95%	100.00%	Distinguish relevant from irrelevant data	100.00%	90.91%
Use syllogistic reasoning	72.73%	100.00%	Use syllogistic reasoning	78.95%	100.00%	Distinguish fact from opinion	100.00%	90.91%
Notice successive stages in which things occur	72.73%	87.50%	Analyze and evaluate arguments	78.95%	100.00%	Connect causes and effects	100.00%	90.91%
Analyze and evaluate arguments	63.64%	85.71%	Use evidence to examine the validity of beliefs	78.95%	86.67%	Analyze and evaluate arguments	100.00%	90.91%
Detect bias, stereotypes	63.64%	71.43%	Recognize analogies and reason by analogy	78.95%	80.00%	Use scientific method as a process of validation	100.00%	72.73%
Use evidence to examine the validity of beliefs	63.64%	71.43%	Notice successive stages in which things occur	73.68%	100.00%	Examine arguments for ambiguity in the line of reasoning	100.00%	72.73%
Connect causes and effects	54.55%	100.00%	Examine arguments for ambiguity in the line of reasoning	73.68%	85.71%	Use syllogistic reasoning	90.91%	90.00%
Use scientific method as a process of validation	45.45%	100.00%	Represent ideas as three-dimensional images	52.63%	90.00%	Detect bias, stereotypes	81.82%	88.89%
Represent ideas as three-dimensional images	0.00%	0.00%	Use scientific method as a process of validation	52.63%	60.00%	Represent ideas as three-dimensional images	81.82%	66.67%

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RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Clerical/Sales			Technical			Professional		
Creative Thinking Skills	Use	Freq	Creative Thinking Skills	Use	Freq	Creative Thinking Skills	Use	Freq
Uses imagery	100.00%	100.00%	Identifies and examines alternatives	100.00%	100.00%	Extrapolates from limited facts	100.00%	100.00%
Uses intuition	100.00%	91.67%	Ranks alternatives and chooses the best	100.00%	100.00%	Generates ideas	100.00%	100.00%
Analyzes open-ended situations and problems	100.00%	90.91%	Uses insight	100.00%	100.00%	Identifies and examines alternatives	100.00%	100.00%
Generates ideas	100.00%	81.82%	Uses intuition	100.00%	100.00%	Uses intuition	100.00%	91.67%
Identifies and examines alternatives	90.91%	90.00%	Lists attributes of objects and situations	100.00%	100.00%	Analyzes open-ended situations and problems	100.00%	90.91%
Ranks alternatives and chooses the best	90.91%	90.00%	Generates ideas	100.00%	100.00%	Lists attributes of objects and situations	100.00%	90.91%
Uses insight	90.91%	90.00%	Synthesizes from various sources to form a new whole	100.00%	100.00%	Generates multiple ideas to support multiple viewpoints	100.00%	90.91%
Identifies relationships between situations that may appear unconnected	81.82%	88.89%	Elaborates details	100.00%	95.00%	Synthesizes from various sources to form a new whole	100.00%	90.91%
Makes unusual connections between facts	81.82%	88.89%	Uses imagery	100.00%	94.74%	Ranks alternatives and chooses the best	100.00%	90.91%
Uses metacognition	81.82%	88.89%	Analyzes open-ended situations and problems	100.00%	94.74%	Uses insight	100.00%	90.91%
Elaborates details	81.82%	77.78%	Identifies relationships between situations that may appear unconnected	100.00%	89.47%	Tolerate ambiguity, hold conclusion off to search for innovative ideas	100.00%	83.33%
Synthesizes from various sources to form a new whole	81.82%	77.78%	Extrapolates from limited facts	100.00%	89.47%	Makes unusual connections between facts	100.00%	81.82%
Extrapolates from limited facts	81.82%	77.78%	Generates multiple ideas to support multiple viewpoints	100.00%	78.95%	Uses metacognition	90.91%	90.00%
Lists attributes of objects and situations	72.73%	87.50%	Tolerate ambiguity, hold conclusion off to search for innovative ideas	100.00%	73.68%	Identifies relationships between situations that may appear unconnected	90.91%	80.00%
Tolerate ambiguity, hold conclusion off to search for innovative ideas	72.73%	62.50%	Makes unusual connections between facts	94.74%	88.89%	Uses imagery	81.82%	100.00%
Uses metadata	54.55%	83.33%	Uses metacognition	89.47%	88.24%	Uses metadata	81.82%	88.89%
Generates multiple ideas to support multiple viewpoints	45.45%	40.00%	Uses metadata	78.95%	60.00%	Elaborates details	72.73%	87.50%

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RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Management					
Information Processing	Use	Freq	Formal Reasoning, Critical Thinking, Logic Skills	Use	Freq
Analyze information or data	100.00%	100.00%	Examine arguments for ambiguity in the line of reasoning	100.00%	100.00%
Process information in a variety of ways	100.00%	100.00%	Determine the meaning of terms and statements	100.00%	100.00%
Research information or data	100.00%	100.00%	Notice qualities of things: how things differ or are alike	100.00%	100.00%
Note similarities and differences between facts	100.00%	100.00%	Notice successive stages in which things occur	100.00%	100.00%
Perform technological assessments	100.00%	90.00%	Break down wholes into component parts	100.00%	100.00%
Design systems	100.00%	88.89%	Identify and sort things into classes	100.00%	100.00%
Identify stated and unstated reasons	100.00%	88.89%	Recognize analogies and reason by analogy	100.00%	100.00%
Recognize associations and connects information	100.00%	87.50%	Judge the credibility of sources	100.00%	100.00%
Form conclusions and generalizations from facts	100.00%	87.50%	Detect bias, stereotypes	100.00%	100.00%
Make predictions on the basis of patterns in data	100.00%	87.50%	Distinguish relevant from irrelevant data	100.00%	100.00%
Evaluate inf. according to set criteria	100.00%	87.50%	Distinguish fact from opinion	100.00%	100.00%
Perform system analysis(trouble shooting]	100.00%	81.82%	Connect causes and effects	100.00%	100.00%
Engineer solutions	87.50%	100.00%	Judge whether a definition is adequate,	100.00%	100.00%
Summarize and condense information, facts	87.50%	100.00%	Use syllogistic reasoning	100.00%	100.00%
Identify inconsistencies, deficiencies, and contradictions	87.50%	85.71%	Analyze and evaluate arguments	100.00%	100.00%
Make inferences	87.50%	85.71%	Represent ideas as three-dimensional images	100.00%	88.89%
Classify facts	87.50%	85.71%	Use evidence to examine the validity of beliefs	100.00%	87.50%
Identify main ideas	75.00%	100.00%	Use scientific method as a process of validation	100.00%	55.56%
Make Decisions based on Information Supplied by Others	75.00%	100.00%			
Design products	75.00%	83.33%			

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RANKED USE AND FREQUENCY OF USE TABLES

Productive Thinking Skills [cont.]

Management					
Judgment & Decision Making Skills	Use	Freq	Creative Thinking Skills	Use	Freq
Identify facts, opinions, and reasoned arguments	100.00%	100.00%	Lists attributes of objects and situations	100.00%	100.00%
Spot inconsistencies and gaps in information	100.00%	100.00%	Generates ideas	100.00%	100.00%
Distinguish between valid and questionable assumptions	100.00%	88.89%	Identifies and examines alternatives	100.00%	100.00%
Recognize evidence and check it	100.00%	87.50%	Ranks alternatives and chooses the best	100.00%	100.00%
Decide whether statements contradict each other	100.00%	87.50%	Uses insight	100.00%	100.00%
Deal with differing value systems	100.00%	75.00%	Uses intuition	100.00%	100.00%
Evaluate others judgments	100.00%	75.00%	Identifies relationships between situations that may appear unconnected	100.00%	100.00%
Gather and organize data	87.50%	100.00%	Makes unusual connections between facts	100.00%	100.00%
			Extrapolates from limited facts	100.00%	100.00%
			Uses imagery	100.00%	100.00%
Problem Solving Skills	Use	Freq	Uses metacognition	100.00%	100.00%
Solve problems on your own	87.50%	100.00%	Elaborates details	100.00%	88.89%
Choose solutions as an individual	87.50%	100.00%	Generates multiple ideas to support multiple viewpoints	100.00%	87.50%
Direct others in the application of the solution	87.50%	100.00%	Synthesizes from various sources to form a new whole	100.00%	87.50%
Identify general problems	75.00%	100.00%	Analyzes open-ended situations and problems	87.50%	100.00%
Determine the attributes of a problem	75.00%	100.00%	Tolerate ambiguity, hold conclusion off to search for innovative ideas	87.50%	85.71%
Clarify the problem for others	75.00%	100.00%	Uses metadata	87.50%	57.14%
Formulate questions about the problem	75.00%	100.00%			
integrate inf. about the problem	75.00%	100.00%			
Formulate solutions	75.00%	100.00%			
Examine and rank solutions	75.00%	100.00%			
Seek acceptance of solutions	75.00%	100.00%			
Monitor solutions	75.00%	100.00%			
Formulate hypotheses for testing	75.00%	83.33%			
Evaluate hypotheses	75.00%	83.33%			
Figure out experiments to test hypotheses	75.00%	83.33%			
Solve problems as a member of a team	75.00%	83.33%			
Choose solutions as a member of a team	75.00%	83.33%			

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